BANGALORE WATER SUPPLY AND SEWERAGE BOARD

CAUVERY BHAVAN, KEMPEGOWDA ROAD,
BANGALORE – 560 009

TENDER FOR THE WORK OF

MODERNIZATION OF EXISTING NETWORK AND REDUCTION IN NON-REVENUEWATER IN ANNAYYAPPA BLOCK DMA COMING UNDER AEE(NE)2SUB-DIVISION LIMITS OF BWSSB, BANGALORE

Office of the Engineer–in-Chief
BANGALORE WATER SUPPLY & SEWERAGE BOARD
2nd floor, Cauvery Bhavan,
K G road, Bangalore 560009.
Telephone – 080 22945105
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TENDER REFERENCE :	:	BWSSB/EIC/ACE(UFW)/TA/5887/2024-25/ Dt: 19-10-2024
DATE OF PUBLICATION IN E-PORTAL	:	24/10/2024
LAST DATE FOR SUBMISSION OF TENDER IN E PORTAL	:	08/11/2024
TIME AND DATE OF OPENING OF TECHNICAL TENDER	:	09/11/2024
PLACE OF OPENING OF TECHINCAL TENDER	:	Office of the Engineer-in-Chief, 2nd floor, Cauvery Bhavan, KG Road, Bangalore – 560 009
TIME AND DATE OF OPENING OF PRICE TENDERS	:	Will be intimated to the Qualified Tenderers
PLACE OF OPENING OF PRICE TENDER	:	Will be intimated to the Qualified Tenderers
ADDRESSFOR COMMUNICATION	:	Engineer-in-Chief 2nd floor, Cauvery Bhavan, KG Road, Bangalore – 560 009 Telephone – 080 22945105 Telefax – 22945105 e-mail – eic@bwssb.gov.in

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SECTION 1:

BANGALORE WATER SUPPLY AND SEWERAGE BOARD
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INVITATION FOR TENDER – SHORT TERM
(ONLY THROUGH KPPP PORTAL)
www.kppp.karnataka.gov.in)

IFT No.: BWSSB/EIC/ACE(UFW/TA/5887/2024-25Dated:19-10-2024

1. The ***Engineer-in-Chief*** invites tender from eligible tenderers, for the construction of work detailed in the Table below through e-PROCUREMENT process with two stages tender procedure in line with the Rule28 of the KTPP Act. The details regarding their qualification to take the tender (as detailed in ITT Clause 4) and the price tender shall be uploaded in the website of the e-procurement wizard. Technical details will be opened on the date and time mentioned in IFT clause 5 and evaluated. The price tender of the Tenderer, who is found to be qualified to execute the tendered works, will be opened on the date notified later. The Tenderers are advised to note the minimum qualification criteria specified in Clause 3 of the Instructions to Tenderers(ITT) to qualify for award of the contract.

2. Tender documents may be downloaded through the e-procurement wizard which will link to www.kppp.karnataka.govt.infrom **24.10.2024 to 08.11.2024**, on payment of a non-refundable fee indicated in the Table below, using any of these forms of OTC,NEFT, DEBIT CARD and CREDIT CARD through e-portal only. Interested tenderers may obtain further information at the Office of e-procurement. Tenderers will be issued a password and authorized for accessing the tender document in the website with URL: **www.kppp.karnataka.govt.in**

3. The Bidders can download the e-tender document using their user ID – password, by accessing **www.kppp.karnataka.govt.in** where electronic tender form is provided. Additional information related to e-tender process can be obtained through the above mentioned website. The electronic tender will be operated as Two stage Tender system by opening the Technical details first and financial portion of the eligible tenderers later.

4. Tenders must furnish Earnest Money Deposit specified for the work in the Table below. Earnest Money Deposit will have to be paid through any one of the forms OTC,NEFT, DEBIT CARD and CREDIT CARD through e-portal only.

Sl. No	Name ofWork	Cost of Tender Document including Taxes Rs.	Amount put to Tender Rs. in Lakh (Approx) (Excluding GST)	Bid Security Rs. in Lakh	Period of completion	Eligibility Criteria during last 5 years (2019-20, 2020-21, 2021-22, 2022-23 & 2023-24)	
						Turnover (in all classes of Civil Engineering construction works) for any of the two years Rs. in Lakhs	Performance & Work Qualification in completed projects during last five financial years i.e. from 2019-2020 to 2023-2024
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Workof Modernization of existing network& reduction in Non-Revenue Water in Annayyappa BlockDMAcoming under AEE(NE)-2 Sub-Division limits of BWSSB, Bangalore.	To be specified by e-procurement cell.	**375.03**	**5.7**	06 months (Including monsoon period)	**885**	**i)**as prime contractor should have satisfactorily completed during the last five years at least one similar work to an extent of 50% of the cost of the work value not less than **Rs.222 lakhs**(Supply,laying, testing and Commissioning of 100mm and above DI/MS pipeline completed in all respects) **ii)**Executed in any one year, the following minimum quantities of work: **a)**Providing, laying, testing and commissioning of DI pipeline completed in all respects100mm-**3832rmt**150mm-**200rmt**,200mm-**400rmt**,250mm-**80rmt**,300mm-**320 rmt** **b)**Providing, laying, testing

							and commissioning of 406mm and above MS pipeline completed in all respects-**240 rmt** **c)**Supply, laying, jointing, Testing and commissioning of service connections making bore holes for fix house service connections including road cutting, excavation, backfilling, disposal and road restoration- **790 Nos**. **d)**Supply, installation and commissioning of EMF Bulk Flow Meters -**2Nos** **(e)** Liquid assets and or availability of credit facilities usually 30% of the amount of contract ie., **Rs. 133 lakhs.**

5. The last date for uploading of completed tender document is on **08/11/2024**upto **16:00 hrs.**

6. The bids will be opened at the office mentioned in para no.12 on **09/11/2024** at **16:00 hrs** in the presence of bidders or their authorized representatives. If the bid opening day remains as public holiday, Bids will be opened on the next working day at the original stipulated time.

7. Bidders can access tender documents from the website and upload the required details; those are mentioned in different sections in the bid document in to electronic tender box on the website. Scanned documents those are required to be furnished as per Section 2, 3 &4 of the bid document shall be submitted through e-portal preferably in **PDF** format for clear vision.

8. The cost of the tender document once paid will not be refunded.

9. The successful bidder would be required to give performance **bank guarantee of 5%** of the contract amount plus additional security for unbalanced bid amount from a Nationalized / Scheduled Indian Bank, with jurisdiction at Bangalore as specified in the clause no.29 of ITT, towards guarantee for completion of work within the stipulated period.

10. Applications / requisitions from joint venture Firms are not acceptable.

11. Bangalore Water Supply and Sewerage Board reserve the right to cancel or annul the entire or part of this process of invitation at any time without assigning any reason.
12. For any additional information regarding the above tender, the firms who are interested to quote, may contact office of the undersigned at the office address given below on all working days during office hours 1030hours to 1700 hours.

Engineer-in-Chief
Bangalore Water Supply and Sewerage Board
2rd Floor, Cauvery Bhavan, Kempe Gowda Road, Bangalore - 560009
Karnataka, India.
Tel Fax: -91-80-22945105
Telephone: +91-80- 22945105
Or **visit Website www.bwssb.gov.in**

Email eic@bwssb.gov.in

1. List of documents to support qualification of bidder is to be uploaded to the e-procurement website www.kppp.karnataka.gov.in
2. Bidders shall submit offers that comply with the requirements of the bid document, **including the basic technical design as indicated in the drawing and specifications**. Alternatives will not be considered. The attention of the bidders is drawn to clause 23 regarding the rejection of the bids, which are not substantially responsive to the requirement of the bid document.
3. Other details can be read from the tender documents.
4. Corrigendum/Addendum/Modification/corrections, if any, will be published in the Web site only.

Engineer-in-Chief
Bangalore Water supply & Sewerage Board

SECTION 2:

INSTRUCTIONS TO TENDERERS (ITT)

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A. General

1. Scope of Tender

1.1 The ***Engineer-in-Chief, BWSSB,*** (Referred to as Employer in these documents) invites tenders following Two Cover e-procurement procedure, from eligible Tenderers, for the construction of work (as defined in these documents and referred to as "the work") detailed in the Table given in the Invitation for Tenders (IFT).

2. Eligible Tenderers

2.1 Tenderers shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Government of Karnataka

2.2 Tenders from Joint ventures are not acceptable.

3. Qualification of the Tenderer:

3.1 All Tenderers shall provide the requested information accurately and in sufficient detail in Section 3: Qualification information.

3.2 Should have Civil Contractor registration in BWSSB or PWD/KUWSSB/KPTCL/CPWD/CEIG etc.,

3.3 **To qualify for award of this contract, each Tenderer in its name should have in the last five years i.e. 2019-20 to 2023-24)**

1. Should have achieved in at least two financial years a minimum financial turnover (in all classes of civil engineering construction works) of **Rs.885Lakhs**

2. The Tenderer as prime contractor should have satisfactorily completed during the last five years at least one similar work to an extent of 50% of the cost of the work value not less than **Rs.222** lakhs(Supply, laying, testing and Commissioning of 100mm and above DI/MS pipeline)

3. Executed in any one year, the following minimum quantities of work:

a. Providing, laying, testing and commissioning of DI pipeline completed in all respects 100mm-**3832rmt** 150mm-**200rmt**,200mm-**400 rmt**,250mm-**80rmt**,300mm-**320 rmt**

b. Providing, laying, testing and commissioning of 406mm and above MS pipeline completed in all respects-**240 rmt**

c. Supply, laying, jointing, Testing and commissioning of service connections making bore holes for fix house service connections including road cutting, excavation, backfilling, disposal and road restoration- **790 Nos**.

d. The work should have been carried out in DMA concept

3.3 **Each Tenderer should further demonstrate**:

Each Tenderer should further demonstrate:

a. Availability by owning 50% of the required / specified key & critical equipment for this work & remaining 50% can be deployed on lease / hire basis for all works provided, the relevant documents (commitment agreements etc.,) for availability for this work shall be furnished. Some of the equipments are as follows:

i. Concrete/Asphalt cutting machine - 2 nos.
iii. Excavators (1 m3) - 2 nos.
iv. Tipper/Dumper Trucks (10 m3) - 1 nos.
v. DG Set (30 KVA) - 1 nos.
vi. Drilling Machine - 2 nos.
vii. HSC cutting machine - 2 nos.
viii. Pipe laying accessories like tripod, chain pully etc. – 1 no.

[In case of hiring, agreement copy for such arrangement shall be furnished]

b. Liquid assets and /or availability of credit facilities of no less than **Rs.133lakh/-**(Credit lines/letter of credit/certificates from Nationalized / Schedule banks in India for meeting the fund requirement etc.,

3.4 To qualify for a package of contracts made up of this and other contracts for which tenders are invited in this IFT, the Tenderer must demonstrate having experience and resources to meet the aggregate of the qualifying criteria for the individual contracts.

3.5 Sub-contractors' experience and resources shall not be taken into account in determining the Tenderer's compliance with the qualifying criteria except to the extent stated in 3.2 (d) and (e) above.

3.6 Tenderers who meet the above specified minimum qualifying criteria, will only be qualified, if their available tender capacity is more than the total tender value. The available tender capacity will be calculated as under:

Assessed available tender capacity = (A*N*1.5 - B)

where

A = Maximum value of civil engineering works executed in any one year during the last five years (updated to **2023-24**price level) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which tenders are invited.

B = Value, at **2023-24** price level, of existing commitments and on-going works to be completed during the next **1** years (period of completion of the works for which Tenders are invited)*

Note: The statements showing the value of existing commitments and on-going works as well as the stipulated period of completion remaining

for each of the works listed should be countersigned by the Employer in charge, not below the rank of an Executive Engineer or equivalent.

3.7 Even though the Tenderers meet the above criteria, they are subject to be disqualified if they have:

- made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.; and/or
- participated in the previous Tender for the same work and had quoted unreasonably high tender prices and could not furnish rational justification.

4. One Tender per Tenderer:

4.1 Each tenderer shall submit only one tender for one package. A tenderer who submits or participates in more than one Tender (other than as a sub-contractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Tenderer's participation to be disqualified.

5. Cost of Tendering:

5.1 The tenderer shall bear all costs associated with the preparation and submission of his tender, and the Employer will in no case be responsible and liable for those costs.

6. Site visit:

6.1 The Tenderer at his own responsibility and risk is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Tender and entering into a contract for construction of the Works. The cost of visiting the Site shall be at the Tenderer's own expense.

B. Tender documents

7. Content of Tender documents

7.1 The set of tender documents shall have all the Sections given in Page 2:

7.2 Both the sets should be completed and returned with the tender.

8. Clarification of Tender Documents

8.1 A prospective tenderer requiring any clarification of the tender documents may notify the Employer in writing or by cable (hereinafter "cable" includes telex, facsimile and e-mail) at the Employer's address indicated in the invitation to tender. The Employer will respond to any request for clarification which he receives earlier than 15 days prior to the deadline for submission of tenders. Copies of the Employer's response will be forwarded to all purchasers of the tender documents through e-mail, including a description of the enquiry but without identifying its

source. Same will available in the website of e-procurement www.kppp.karnataka.gov.in.

8.2 Pre-tender meeting:

8.2.1 **Deleted.**

8.2.2 **Deleted.**

8.2.3 **Deleted.**

8.2.4 **Deleted.**

8.2.5 **Deleted.**

9. Amendment of Tender documents

9.1 Before the deadline for submission of tenders, the Employer may modify the tender documents by issuing addenda.

9.2 Any addendum thus issued shall be part of the tender documents and shall be communicated in writing or by cable to all the purchasers of the tender documents.

9.3 To give prospective Tenderers reasonable time in which to take an addendum into account in preparing their tenders, the Employer shall extend as necessary the deadline for submission of tenders, in accordance with Sub-Clause 16.2 below.

C. Preparation of Tenders

10. Documents comprising the Tender

10.1 The tender submitted in e-procurement portal by the Tenderer shall contain the documents as follows:

(a) Scanned copy of Earnest Money Depositmade ;
(b) Scanned copies of Qualification Information as per formats given in Section 3;
(c) The Tender (in the format indicated in Section 4)
(d) Priced Bill of Quantities (Section 9);

and any other materials required to be completed and submitted by Tenderers in accordance with these instructions. The documents listed under Sections 3, 4, 6 and 9 shall be filled in without exception. The Earnest Money Deposit shall be submitted to the Tender inviting authority on or before the time of submission mentioned in IFT. PHOTOCOPIES OF THE DOCUMENTS SHOULD BE NOTARISED.

10.2 Tenderers submitting tenders together with other contracts stated in the IFT to form a package will so indicate in the tender together with any discounts offered for the award of more than one contract.

11. Tender prices

11.1 The contract shall be for the whole works as described in Sub-Clause 1.1, based on the priced Bill of Quantities submitted by the Tenderer.

11.2 The bidder shall fill in the unit rates in figures for all items of the Works described in the Bill of Quantities. The system will automatically convert the unit rates mentioned in figures to words and also calculate the amount of that item as well as the total Bid value.*Items for which no rate is entered by the bidder will not be paid for by the Employer when executed and shall be deemed covered by the other rates in the Bill of Quantities*

11.3 All duties, taxes, and other levies payable by the contractor under the contract, or for any other cause, shall be included in the rates, prices and total Tender Price submitted by the Tenderer.

11.4 Deleted

12. Tender validity

12.1 Tenders shall remain valid for a period not less than **ninety days** after the deadline date for tender submission specified in Clause 16. A tender valid for a shorter period shall be rejected by the Employer as non-responsive.

12.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the Tenderers may extend the period of validity for a specified additional period. The request and the Tenderers' responses shall be made in writing or by cable or e-mail. A Tenderer may refuse the request without forfeiting his earnest money deposit. A Tenderer agreeing to the request will not be required or permitted to modify his tender, but will be required to extend the validity of his earnest money deposit for a period of the extension, and in compliance with Clause 13 in all respects.

13. Earnest money deposit

13.1 The Tenderer shall furnish, as part of his tender, earnest money deposit in the amount as shown in column 2 of the Table of IFT for this particular work. This earnest money deposit shall be in favour of ***Chairman, BWSSB*** and may be in the form of Banker's cheque/ Demand draft/Pay Order, in favour of ***Chairman, BWSSB*** payable at ***BANGALORE*** from any Nationalized / Scheduled Indian banks.

13.2 Instruments having fixed validity issued as earnest money deposit for the tender shall be valid for 45 days beyond the validity of the tender.

13.3 Any tender not accompanied by an acceptable earnest money deposit and not secured as indicated in Sub-Clauses 13.1 and 13.2 above shall be rejected by the Employer as non-responsive.

13.4 The earnest money deposit of unsuccessful Tenderers will be returned within 30 days of the end of the tender validity period specified in Sub-Clause 12.1.

13.5 The earnest money deposit of the successful Tenderer will be discharged when the Tenderer has signed the Agreement and furnished the required Performance Security.

13.6 The earnest money deposit may be forfeited:

(a) if the Tenderer withdraws the Tender after tender opening during the period of tender validity;
(b) if the Tenderer does not accept the correction of the Tender Price, pursuant to Clause 24; or
(c) in the case of a successful Tenderer, if the Tenderer fails within the specified time limit to
  (i) sign the Agreement; or
  (ii) furnish the required Security deposit

14. Format and signing of Tender

14.1 The completed bid comprising of documents indicated in ITB 12, should be uploaded in the**e procurement portal of BWSSB** through the website**www.kppp.karnataka.gov.in**along with scanned copies of requisite certificates those are mentioned in different sections in the bid document and scanned copy of Bid Security / EMD in case it is provided in the form of Banker's cheque/ Demand draft/Pay Order

14.2 All the documents should be uploaded to the **e procurement portal of BWSSB**. Tenderer should take a print out of the declaration letter provided in the website on company letter head and should sign, stamp and upload the same to the tender wizard of BWSSB.

14.3 Deleted

D. Submission of Tenders

15. Up-loading & submission of tenders

15.1 The tenders should be uploaded only through **e-procurement portal**. Tender should contain

A. Technical Tender consisting of following:

a. All the documents with required details in prescribed format; those are mentioned in different sections in the Tender. Form of Tender, Declaration statement regarding Customs/ Excise duty exemption for materials/ construction equipment brought to site as mentioned in Section 2, etc., shall be downloaded, filled with

required details, signed, scanned& uploaded to the e-procurement portal website**www.kppp.karnataka.gov.in/BWSSB** on or before the time and date indicated in notification /Section I IFT.

b. **Tender security.** Tender security can be paid to BWSSB in the form of Banker's cheque/ Demand draft/Pay Order(the details like reference number, date, name of the Bank and drawn in favour are to be registered on the tender wizard of BWSSB)

The above documents along with notarized copies of documentary evidences as indicated in Section—II ITT, Section-III Qualification information & Section IV Forms of Tender shall be scanned and uploaded to the website compulsorily, failing which tender will be rejected in view of incomplete bid document and

B. Financial Tender consisting ofBill of Quantities (file name: BOQ.xls). The tenderer shall down load the bill of quantities and key in the rates (in figures only) in the Bill of Quantities sheet and upload the same file on to the website on or before the time and date indicated in notification /Section I IFT.

NOTE:

1. URL of the Website for tender submission through e-procurement portal is as follows:

i www.kppp.karnataka.gov.in.

ii **Engineer-in-Chief**
Bangalore Water Supply and Sewerage Board,
2nd Floor, Cauvery Bavan,
K.G.Road, Bangalore560009
Karnataka, India.
Tel Fax; +91-80-22945105, Telephone: +91-80- 22945105

2. The details related to submission of tenders, downloading / uploading of documents or other details are available online in the help wizard, Vendor manual & FAQ of above website. The same is provided along with sample formats in Annexure-I of the Bid document for ready reference.

15.2 Deleted

15.3 Unique Identification Number will be automatically generated by the server with time -stamp and sent to the account of the bidder as an acknowledgement after bidder finally uploads the bids.

15.4 Deleted

16. Deadline for submission of the Tenders

16.1 Tenders must upload all the tender documents in the e-procurement portal no later than**/11/2024Upto 16.00 Hrs**. In the event of the specified date for the submission of tenders being changed/postponed by the Employer due to unforeseen circumstances, the corrigendum will be issued in the news paper& the deadline for submission of tenders will be intimated accordingly.

16.2 The Employer may extend the deadline for submission of tenders by issuing an amendment/corrigendum in accordance with Clause 9, in which case all rights and obligations of the Employer and the Tenderers previously subject to the original deadline will then be subject to the new deadline.

17. Late Tenders

17.1 The software of e-procurement system will not allow the Bidder to upload the documents after expiration of the stipulated date & time of Bid submission. The Bidder shall refer the server time, which will be displayed in the e-procurement portal of BWSSB. Employer will not be responsible for non-receipt of bids on the stipulated date & time prescribed in clause 16, due to Internet Problems, improper uploading or any other related problems. In case of connectivity problems, Tenderer may contact Helpdesk of the e-tender service provider and may also draw the attention of tender inviting authority.

18. Modification and Withdrawal of Tenders

18.1 Tenderers may "modify" and "withdraw" their tenders multiple numbers of times, until the deadline for submission of tenders by operating the relevant provision made in e-tendering. If the Tenderer withdraws the tender before the deadline for submission of tenders and later if he is interested to submit the tender once again, may do so within the stipulated date & time as mentioned in Clause 16. In this case within the stipulated date & time, the tenderer can once again submit the requisition to the officer inviting tenders for access to the withdrawn tender document for resubmission. For this tenderer need not make any additional payment towards the cost of tender document.Communication of modification / withdrawal by other means will not be accepted.

18.2 Deleted.

18.3 No Tender may be modified after the deadline for submission of Tenders.

18.4 Withdrawal or modification of a Tender between the deadline for submission of Tenders and the expiration of the original period of Tender validity specified in Clause 12.1 above or as extended pursuant to Clause 12.2 may result in the forfeiture of the earnest money deposit pursuant to Clause 13.

18.5 Tenderers may offer discounts for individual items by simply modifying the quoted unit price in the Bill of Quantities. Also, Tenderer may enter their overall discount, at specified location in the Bill of Quantities only, by submitting tender modifications in accordance with this clause. Communication of discount by other means will not be accepted.

E. Tender opening and evaluation

19. Opening of Technical portion of Tenders and evaluation to determine qualified Tenderers:

19.1 The Employer will open the Technical details of all the Tenders received (except those withdrawn), including modifications made pursuant to Clause 18, in the presence of the Tenderers or their representatives on **09**/11/**2024** after **16:00 hrs**. In the event of the specified date of Tender opening being declared a holiday for the Employer, the Tenders will be opened at the appointed time and location on the next working day.

19.2 WITHDRAWAL proposal submitted pursuant to clause 18 shall be read out first and their bids shall not be opened.

19.3 The Tenderers names, the presence or absence of earnest money deposit (amount, format and validity), the submission of qualification information and such other information as the Employer may consider appropriate will be announced by the Employer at the opening.

19.4 The Employer shall prepare minutes of the Tender opening, including the information disclosed to those present in accordance with Sub-Clause 19.3.

19.5 The Price Tenders of all the Tenderers including modifications for Financial tenders can not be opened as this is programmed to open later after evaluation of the Technical details of the participating Tenderers.

19.6 The Employer will evaluate and determine whether each tender (a) meets the eligibility criteria defined in ITT Clause 2; (b) is accompanied by the required earnest money deposit as per stipulations in ITT Clause and (c) meets the minimum qualification criteria stipulated in ITT Clause 3. The Employer will draw out a list of qualified Tenderers.

20. Opening of Price Tender of qualified Tenderers and evaluation:

20.1 The Employer will inform all the Qualified Tenderers the time, date and venue fixed for the opening of the price Tenders. The Employer will open the price tender of Qualified Tenderers at the appointed time and date in the presence of the Tenders or their representatives who choose to attend. In the event of the specified date of Price tender opening being declared a holiday for the Employer, the price tenders will be opened at the appointed time and location on the next working day.

20.2 Deleted.

20.3 The Tenderers' names, the Tender prices, the total amount of each Tender, any discounts, and withdrawals, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening. No Tender shall be rejected at Tender opening.

20.4 The Employer shall prepare minutes of the Price Tender opening, including the information disclosed to those present in accordance with Sub-Clause 20.3.

21. Process to be confidential

21.1 Information relating to the examination, clarification, evaluation, and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Tenderers or any other persons not officially concerned with such process until the award to the successful Tenderer has been announced. Any effort by a Tenderer to influence the Employer's processing of Tenders or award decisions may result in the rejection of his Tender.

22 Clarifications of Tenders

22.1 To assist in the examination, evaluation, and comparison of Tenders, the Employer may, at his discretion, ask any Tenderer for clarification of his Tender, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Tender shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Tenders in accordance with Clause 24.

22.2 Subject to sub-clause 22.1, no Tenderer shall contact the Employer on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Employer, it should do so in writing.

22.3 Any effort by the Tenderer to influence the Employer in the Employer's Tender evaluation, Tender comparison or contract award decisions may result in the rejection of the Tenderers' Tender.

23. Examination of Tenders and determination of responsiveness

23.1 Prior to the detailed evaluation of Tenders, the Employer will determine whether each Tender; (a) has been properly signed; and; (b) is substantially responsive to the requirements of the Tender documents like [(a)Form of Tender, (b)Declaration statement regarding Customs/ Excise duty exemption for materials/ construction equipment brought to site as mentioned in Section 2 etc.,] Scanned / uploaded [including documents those are required to be furnished as per Section 2, 3 & 4 of the tender,]; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the tendering documents.

23.2 A substantially responsive Tender is one which conforms to all the terms, conditions, and specifications of the Tender documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Tender documents, the Employer's rights or the Tenderer's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Tenderers presenting substantially responsive Tenders.

23.3 If a Tender is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

24. Correction of errors

24.1 (a) Once the Tenderer key in the rates in figures, in the Bill of quantities provided, rate in words will be auto generated by the system.

(b) Once the Tenderer key in the rates in figures, in the Bill of quantities provided, the system will automatically calculate the amount of that item as well as the total Bid value.

24.2 Deleted

25. Evaluation and comparison of Tenders

25.1 The Employer will evaluate and compare only the Tenders determined to be substantially responsive in accordance with Clause 23.

25.2 In evaluating the Tenders, the Employer will determine for each Tender the evaluated Tender Price by adjusting the Tender Price as follows:

(a) making any correction for errors pursuant to Clause 24; and

(b) making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Sub Clause 18.5.

25.3 The Employer reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the Tender documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Tender evaluation.

25.4 The estimated effect of the price adjustment conditions under Clause 41 of the Conditions of Contract, during the implementation of the Contract, will not be taken into account in tender Evaluation

25.5 If the tender of the successful tenderer is seriously unbalanced in relation to the Employer's estimate of the cost of the work to be performed under the contract, the Employer may require the Tenderer to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 29 be increased at the expense of the successful Tenderer to a level sufficient to protect the Employer against financial loss in the event of default of the successful under the contract.

F. Award of Contract

26. Award criteria

26.1 Subject to Clause 27, the Employer will award the Contract to the Tenderer whose Tender has been determined to be substantially responsive to the Tender documents and who has offered the lowest evaluated Tender Price, provided that such Tenderer has been determined to be (a) eligible in accordance with the provisions of Clause 2, and (b) qualified in accordance with the provisions of Clause 3.

27. Employer's right to accept any Tender and to reject any or all Tenders

27.1 Notwithstanding Clause 26, the Employer reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the Employer's action.

28. Notification of award and signing of Agreement

28.1 The Tenderer whose Tender has been accepted will be notified of the award by the Employer prior to expiration of the Tender validity period by cable, telex, e-mail or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

28.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of Security deposit in accordance with the provisions of Clause 29.

28.3 The Agreement will incorporate all agreements between the Employer and the successful Tenderer. It will be kept ready for signature of the successful Tenderer in the office of Employer within 30 days following the notification of award along with the Letter of Acceptance. Within 20 days of receipt, the successful Tenderer will sign the Agreement and deliver it to the Employer.

28.4 Upon the furnishing by the successful Tenderer of the Performance Security, the Employer will promptly notify the other Tenderers that their Tenders have been unsuccessful.

29. Security deposit

29.1 Within 20 days of receipt of the Letter of Acceptance, the successful Tenderer shall deliver to the Employer a Security deposit in any of the forms given below for an amount equivalent to 5% of the Contract price plus additional security for unbalanced tenders in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract. :

- Cash or

- Banker's cheque/Demand draft,/Pay Order in favour of ***Chairman, BWSSB*** payable at ***Bangalore*** or

- A bank guarantee in the form given in Section 10; or

29.2 If the security deposit is provided by the successful Tenderer in the form of a Bank Guarantee, it shall be issued either by anationalized/Scheduled bank.

29.3 The security deposit if furnished in cash or demand draft can, if requested, be converted to interest bearing securities at the cost of the contractor.

29.4 Failure of the successful Tenderer to comply with the requirements of Sub-Clause 29.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Earnest money deposit.

30 Advance Payment and Security:

30.1 The Employer will provide an advance payment on the contract price as stipulated in the Conditions of Contract, subject to the maximum amount as stated in the Contract Data.

31. Corrupt or Fraudulent practices

31.1 The GOK requires that the Tenderers/Suppliers/Contractors, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, GOK :

(a) will reject a proposal for award if it determines that the Tenderer recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;

(b) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a GOK contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a GOK contract.

31.2 Furthermore, Tenderers shall be aware of the provision stated in sub-clause 50.2 of the Conditions of Contract.

SECTION 3:

QUALIFICATION INFORMATION

The following form is to be downloaded, particulars are to be filled, scanned & uploaded by the Bidder, to the tender wizard of BWSSB "www.kppp.karnataka.gov.in" along with the Bid.

Note: The detailed procedure for downloading / uploading the documents will be available in Help wizard, Vendor manual & FAQ of the above mentioned Website.

The information to be filled in by the Tenderer hereunder will be used for purposes of computing Tender capacity as provided for in Clause 3 of the Instructions to Tenderers. This information will not be incorporated in the Contract.

1.1 Constitution or legal status of Tenderer [Attach copy]
Place of Registration _____
(Attach Copy)

Principal place of business: _____

1.2 Total value of civil engineering construction works executed and payments received in the last five years (in Rs. Lakhs)

2019 - 20 _____
2020 – 21 _____
2021 – 22 _____
2022 – 23 _____
2023 – 24 _____

1.3 Work performed as Prime Contractor (in the same name) on works of similar nature over during the five years specified in 1.2 above.

Project Name	Name of Employer	Description of Work	Contract Number	Value of contract Rs. Lakhs	Date of issue of work order	Specified period of completion	Actual date of completion	Remarks explaining reasons for delay in completion of work
1	2	3	4	5	6	7	8	9

1.4 Quantities of work executed as prime contractor (in the same name) during the last five years specified in 1.2 above:

Year	Name of Work	Name of Employer	Quantity of work performed (cum)[1]		Remarks (Indicate contract reference)
			Pipeline laid	Earthworks	
2019-20					
2020-21					
2021-22					
2022-23					
2023-24					

[1] Items of work for which data is requested should tally with that specified in ITT Clause 3

1.5 Information on works for which Tenders have been submitted and works which are yet to be completed as on the date of this Tender.

(A) Existing commitments and on-going works:

Description of Work	Place & State	Contract No. & Date	Name and Address of Employer	Value of Contract (Rs. lakhs)	Stipulated period of completion	Value of works[2] remaining to be completed (Rs. lakhs)	Anticipated date of completion
1	2	3	4	5	6	7	8

(B) Works for which Tenders already submitted:

Description of Work	Place & State	Name and Address of Employer	Estimated value of works (Rs. lakhs)	Stipulated Date period of completion	when decision is expected	Remarks if any
1	2	3	4	5	6	7

1.6. The following items of equipment are considered essential for successfully carrying out the works. The Tenderer should furnish all the information listed below.

Item of Equipment	Requirement[3]			Owned and available		Remarks
	No.	Capacity	Owned	Number/ Capacity	Age/ Condition	

1.7 Reports on the financial standing of the tenderer, such as profit and loss statements and auditor's reports for the last five years;

1.8 Qualification and experience of the key technical and management personnel in permanent employment with the tenderer and those that are proposed to be deployed on this contract, if awarded.

1.9. Name, address, and telephone, telex, and fax numbers of the Tenderers' bankers who may provide references if contacted by the Employer.

1.10 Evidence of access to financial resources to meet the qualification requirement specified in ITT Clause3.3 (b): Cash in hand, Letter of Credit etc. List them below and attach certificate from the Banker in the suggested format as under:

[2]Contractor shall enclose / attach / up load all necessary certificates duly attested by the employer

[3]The Item of equipment, required number and capacity should match with those in ITT Clause 3.3(a) (Filled scanned & uploaded)

BANKER'S CERTIFICATE

This is to certify that M/s. …….. is a reputed company with a good financial standing. If the contract for this work, namely …… (name of the work) is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of Rs. …… to meet the working capital requirements for executing the above contract.

Sd/-
Name of the Bank, Senior Bank Manger
Address:……

1.11 Proposals for subcontracting components of works amounting to more than 20% of the contract price .

Item of Work	Value of Sub-Contract	Identified Sub-Contractor (Name and address)	Experience of similar work [4]

1.12 Information on litigations in which the Tenderer is involved:

Other Party (ies)	Employer	Details of dispute	Amount involved	Remarks showing present status

1.13 The proposed methodology and program of construction, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones.

[4] Attach Certificate from the respective Employers (scanned & Uploaded)

SECTION 4:

FORMS OF TENDER, LETTER OF ACEPTANCE, NOTICE TO PROCEED WITH THE WORK AND AGREEMENT FORM

Form of Tender

Description of the Works: **Tender for the Work of Modernization of existing network & reduction in Non-Revenue Water in Annayyappa Block DMA coming under AEE(NE)-2 Sub-Division limits of BWSSB, Bangalore.**

Tender

To
Engineer-in-Chief,
Bangalore Water Supply and Sewerage Board,
2nd Floor, Cauvery Bavan,
K.G.Road, Bangalore560009

GENTLEMEN,

We offer to execute the Works described above in accordance with the Conditions of Contract accompanying this Tender for the Contract Price of _____ [in figures] (_____) [in letters].[5]

This Tender and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any Tender you receive.

The advance payment required is Rs…….

We undertake that, in competing for (and, if the award is made to us, in executing) the above contract, we will strictly observe the laws against fraud and corruption in force in India namely "Prevention of Corruption Act 1988".

We hereby confirm that this Tender complies with the Tender validity and Earnest money deposit required by the Tender documents.

We attach herewith our current income-tax clearance certificate.

Yours faithfully,

Authorized Signature:

Name & Title of Signatory: _____

Name of Tenderer _____

Address: ----------

Letter of Acceptance

(letterhead paper of the Employer)
_____[date]

To:

_____
[name and address of the Contractor]

Dear Sirs,

This is to notify you that your Tender dated _____ for execution of the _____ _____ [name of the contract and identification number, as given in the Instructions to Tenderers] for the Contract Price of Rupees ——— _____ (_____) [amount in words and figures], as corrected and modified in accordance with the Instructions to Tenderers is hereby accepted by our Agency.

You are hereby requested to furnish Security deposit plus additional security for unbalanced tenders in terms of Clause 25.5 of ITT, in the form detailed in Clause 29.1 of ITT for an amount of Rs.————— within 20 days of the receipt of this letter of acceptance valid up to 30 days from the date of expiry of Defects Liability Period i.e. up to ..... and sign the contract, failing which action as stated in Para 29.4 of ITT will be taken.

Yours faithfully,

Authorized Signature
Name and Title of Signatory
Name of Agency

Issue of Notice to proceed with the work
(letterhead of the Employer)
————— (date)
To
————————————— (name and address of the Contractor)
———————————————
———————————————

Dear Sirs:

Pursuant to your furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement for the construction of ——————— [name of the contract] a Tender Price of Rs.———————, you are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

(Signature, name and title of signatory authorized to sign on behalf of Employer)

Agreement Form

Agreement

This agreement, made the _____day of _____20_____, between_____ _____[name and address of Employer] (hereinafter called "the Employer") of the one part and _____ _____ _____ __ _____[name and address of contractor] (hereinafter called "the Contractor") of the other part.

Whereas the Employer is desirous that the Contractor execute _____ _____ _____ _____[name and identification number of Contract] (hereinafter called "the Works") and the Employer has accepted the Tender by the Contractor for the execution and completion of such Works and the remedying of any defects therein at a contract price of Rupees.....

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.
2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.
3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.
4. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz:
   i) Letter of Acceptance;
   ii) Notice to proceed with the works;
   iii) Contractor's Tender;
   iv) Contract Data;
   v) Conditions of contract (including Special Conditions of Contract);
   vi) Specifications;
   vii) Drawings;
   viii) Bill of Quantities; and
   ix) Any other document listed in the Contract Data as forming part of the contract.

In witness whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

The Common Seal of _____
was hereunto affixed in the presence of:
Signed, Sealed and Delivered by the said _____ _____

in the presence of:
Binding Signature of Employer _____
Binding Signature of Contractor _____

SECTION 5:

CONDITIONS OF CONTRACT

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Conditions of Contract

A. General

1. Definitions

1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Bold letters are used to identify defined terms.

Bill of Quantities means the priced and completed Bill of Quantities forming part of the Tender.

Compensation events are those defined in Clause 38 hereunder.

The **Completion Date** is the date of completion of the Works as certified by the Employer in accordance with Sub Clause 46.1.

The **Contract** is the contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.2 below.

The **Contract Data** defines the documents and other information which comprise the Contract.

The **Contractor** is a person or corporate body whose Tender to carry out the Works has been accepted by the Employer.

The **Contractor's Tender** is the completed Tender document submitted by the Contractor to the Employer.

The **Contract price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; months are calendar months.

A **Defect** is any part of the Works not completed in accordance with the Contract.

The **Defects liability period** is the period named in the Contract Data and calculated from the Completion Date.

The **Employer** is the party who will employ the Contractor to carry out the Works.

Equipment is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

The **Initial Contract price** is the Contract Price listed in the Employer's Letter of Acceptance.

The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Employer by issuing an extension of time.

Materials are all supplies, including consumables, used by the contractor for incorporation in the Works.

Plant is any integral part of the Works which is to have a mechanical, electrical, electronic or chemical or biological function.

The **Site** is the area defined as such in the Contract Data.

Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Employer.

The **Start Date** is given in the Contract Data. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.

A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract which includes work on the Site.

A **Variation** is an instruction given by the Employer which varies the Works.

The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Employer will provide instructions clarifying queries about the Conditions of Contract.

2.2 The documents forming the Contract shall be interpreted in the following order of priority:

(1) Agreement
(2) Letter of Acceptance, notice to proceed with the works
(3) Contractor's Tender
(4) Contract Data
(5) Conditions of Contract
(6) Specifications
(7) Drawings
(8) Bill of quantities and
(9) any other document listed in the Contract Data as forming part of the Contract.

3. Law governing contract

3.1 The law governing the Contract is the Laws of India supplanted by the Karnataka Local Acts.

4. Employer's decisions

4.1 Except where otherwise specifically stated, the Employer will decide contractual matters between the Employer and the Contractor .

5. Delegation

5.1 The Employer may delegate any of his duties and responsibilities to other people after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6. Communications

6.1 Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. Subcontracting

7.1 Deleted

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer.

9. Personnel

9.1 The Contractor shall employ the technical personnel (of number and qualifications) as may be stipulated by GOK from time to time during the execution of the work. The technical staff so employed shall be available at site as may be stipulated by the Employer.

9.2 If the Employer asks the Contractor to remove a person who is a member of the Contractor's staff or his work force stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's and Contractor's risks

10.1 The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Employer's risks

11.1 The Employer is responsible for the excepted risks which are:

(a) rebellion, riot commotion or disorder unless solely restricted to employees of the Contractor or his Sub-Contractors arising from the conduct of the Works; or

(b) a cause due solely to the design of the Works, other than the Contractor's design; or

(c) any operation of the forces of nature (in so far as it occurs on the Site) which an experienced contractor:

(i) could not have reasonably foreseen; or

(ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures;
(A) prevent loss or damage to physical property from occurring by taking appropriate measures or
(B) insure against such loss or damage

12. Contractor's risks

12.1 All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. Insurance:

13.1 The Contractor shall prior to commencing the works, effect and thereafter maintain insurances , in the joint names of the Employer and the Contractor, (cover from the first working day after the Start Date to the end of Defects Liability Period), in the amounts stated in the Contract Data :
(a) for loss of or damage to the Works, Plants and Materials and the Contractor's equipment;
(b) for liability of both Parties for loss, damage, death and injury to third parties or their property arising out of the Contractor's performance of the Contract including the Contractor's liability for damage to the Employer's property other than the Works and
(c) for liability of both Parties and of any Employer's representative for death and injury to the Contractor's personnel except to the extent that liability arises from the negligence of the Employer, any Employer's representative or their Employees.

13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Employer for his approval before the Start Date. All such insurance shall provide for compensation to be payable to rectify the loss or damage incurred. All payments received from insurers relating to loss or damage shall be held jointly by the Parties and used for the repair of the loss or damage or as compensation for loss or damage that is not to be repaired.

13.3 If the Contractor fails to effect or keep in force any of the insurances referred to in the previous sub-clauses or fails to provide satisfactory evidence, policies or receipts, the Employer may without prejudice to any other right or remedy, effect insurance for the cover relevant to such default and pay the premiums due and recover the same as a deduction from any other monies due to the Contractor. If no payment is due, the payment of the premiums shall be a debt due.

13.4 Alterations to the terms of insurance shall not be made without the approval of the Employer.

13.5 Both Parties shall comply with any conditions of the insurance policies.

14. Site Investigation Reports:

14.1 The Contractor, in preparing the tender, shall rely on any site investigation reports referred to in the Contract data, supplemented by any information available to the Tenderer.

15. Queries about the Contract Data

15.1 The Employer will clarify queries on the Contract Data.

16. Contractor to construct the Works

16.1 The Contractor shall construct the Works in accordance with the Specification and Drawings.

17. The Works to be completed by the Intended Completion Date

17.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the program submitted by the Contractor, as updated with the approval of the Employer, and complete them by the Intended Completion Date.

18. Approval by the Employer:

18.1 The Contractor shall submit Specification and drawings showing the proposed Temporary Works to the Employer, who is to approve them if they comply with the Specifications and Drawings.

18.2 The Contractor shall be responsible for the design of Temporary Works

18.3 The Employer's approval shall not alter the Contractor's responsibility for design of the Temporary Works.

18.4 The Contractor shall obtain approval of third parties to the design of third parties to the design of the temporary Works where required.

18.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Employer before their use.

19. Safety

19.1 The Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries

20.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Employer of such discoveries and carry out the Employer's instructions for dealing with them.

21. Possession of the Site

21.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the

Employer is deemed to have delayed the start of the relevant activities and this will be Compensation Event.

22. Access to the Site

22.1 The Contractor shall allow the Employer and any person authorized by the Employer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured / fabricated / assembled for the works.

23. Instructions

23.1 The Contractor shall carry out all instructions of the Employer which comply with the applicable laws where the Site is located.

24. Procedure for resolution of Disputes:

24.1 If the Contractor is not satisfied with the decision taken by the Employer, the dispute shall be referred by either party to Arbitration within 30 days of the notification of the Employer's decision.

24.2 If neither party refers the dispute to Arbitration within the above 30 days, the Employer's decision will be final and binding.

24.3 The Arbitration shall be conducted in accordance with the arbitration procedure stated in the Special Conditions of Contract.

B. Time Control

25. Program

25.1 Within the time stated in the Contract Data the Contractor shall submit to the Employer for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works.

25.2 The Employer's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Employer again at any time. A revised Program is to show the effect of Variations and Compensation Events.

26. Extension of the Intended Completion Date

26.1 The Employer shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date.

26.2 The Employer shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Employer for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information.

27. Delays ordered by the Employer

27.1 The Employer may instruct the Contractor to delay the start or progress of any activity within the Works.

28. Management meetings

28.1 The Employer may require the Contractor to attend a management meeting. The business of a management meeting shall be to review the progress achieved and the plans for remaining work.

28.2 The responsibility of the parties for actions to be taken is to be decided by the Employer either at the management meeting or after the management meeting and stated in writing to be distributed to all who attended the meeting.

C. Quality Control

29. Identifying defects

29.1 The Employer shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Employer may instruct the Contractor to search for a Defect and to uncover and test any work that the Employer considers may have a Defect

30. Tests

30.1 If the Employer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

31. Correction of defects

31.1 The Employer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

31.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Employer's notice.

32. Uncorrected defects

32.1 If the Contractor has not corrected a Defect within the time specified in the Employer's notice, the Employer will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

D. Cost Control

33. Bill of Quantities (BOQ)

33.1 The BOQ shall contain items for the construction, installation, testing, and commissioning work to be done by the Contractor.

33.2 The BOQ is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the BOQ for each item

34. Variations

34.1 The Employer shall have power to order the Contractor to do any or all of the following as considered necessary or advisable during the progress of the work by him

(a) Increase or decrease of any item of work included in the Bill of Quantities (BOQ);
(b) Omit any item of work;
(c) Change the character or quality or kind of any item of work;
(d) Change the levels, lines, positions and dimensions of any part of the work;
(e) Execute additional items of work of any kind necessary for the completion of the works; and
(f) Change in any specified sequence, methods or timing of construction of any part of the work.

34.2 The Contractor shall be bound to carry out the work in accordance with any instructions in this connection, which may be given to him in writing by the Employer and such alteration shall not vitiate or invalidate the contract.

34.3 Variations shall not be made by the Contractor without an order in writing by the Employer, provided that no order in writing shall be required for increase or decrease in the quantity of an item appearing in the BOQ so long as the work executed conforms to the approved drawings.

34.4 The Contractor shall promptly request in writing the Employer to confirm verbal orders and the officer issuing oral instructions shall confirm it in writing with in 30days, failing which the work shall be carried out as though there is no variation. In case variation is approved, it shall be accompanied by BOQ, failing which the contractor shall be responsible for deviation, if any. Further, approval of the Board has to be obtained for the variation exceeding 5%.

35. Payments for Variations

35.1 Payment for increase in the quantities of an item in the BOQ up to 25% of that provided in the Bill of Quantities shall be made at the rates quoted by the Contractor.

35.2 For quantities in excess of 125% of the tendered quantity of an item as given in the BOQ, the Contractor shall be paid at the rate entered in or derived from in the Schedule of Rates (applicable for the area of the work and current at the time of award of contract) plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates prevalent at the time of award of contract.

35.3 If there is no rate for the additional, substituted or altered item of the work in the BOQ, efforts would be made to derive the rates from those given in the BOQ or the Schedule of Rates (applicable for the area of the work and current at the time of award of contract) and if found feasible the payment would be made at the derived rate for the item plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates prevalent at the time of award of contract

35.4 If the rates for additional, substituted or altered item of work cannot be determined either as at 35.1 or 35.2 or 35.3 above, the Contractor shall be requested to submit his quotation for the items supported by analysis of the rate or rates claimed, within 7 days.

35.5 If the Contractor's quotation is determined unreasonable, the Employer may order the Variation and make a change to the Contract Price which shall be based on Employer's own forecast of the effects of the Variation on the Contractor's costs.

35.6 If the Employer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

35.7 Under no circumstances the Contractor shall suspend the work on the plea of non-settlement of rates for items falling under this Clause.

36. Submission of bills for payment

36.1 The Contractor shall submit to the Employer monthly bills of the value of the work completed less the cumulative amount paid previously.

36.2 The Employer shall check the Contractor's bill and determine the value of the work executed which shall comprise of (i) value of the quantities of the items in the BOQ completed and (ii) valuation of Variations and Compensation Events.

36.3 The Employer may exclude any item paid in a previous bill or reduce the proportion of any item previously paid in the light of later information.

37. Payments

37.1 Payments shall be adjusted for deductions for advance payments, other recoveries in terms of the contract and taxes, at source, as applicable under the law. The Employer shall pay the Contractor the within 60 days of submission of bill. The Contractor shall be liable to pay liquidated damages for shortfall in progress. For Progress beyond the agreed programme, payment is subject to availability of the grants.

37.2 Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

38. Compensation events

38.1 The following are Compensation events unless they are caused by the Contractor:

(a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.
(b) The Employer orders a delay or does not issue drawings, specifications or instructions required for execution of works on time.
(c) The Employer instructs the Contractor to uncover or to carry out additional tests upon work which is then found to have no Defects.
(d) The Employer gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.
(e) The effect on the Contractor of any of the Employer's Risks.
(f) The Employer unreasonably delays issuing a Certificate of Completion.
(g) Other Compensation Events listed in the Contract Data or mentioned in the Contract.

38.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date is extended. The Employer shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

38.3 As soon as information demonstrating the effect of each Compensation event upon the Contractor's forecast cost has been provided by the Contractor, it is to be assessed by the Employer and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Employer shall adjust the Contract Price based on Employer's own forecast. The Employer will assume that the Contractor will react competently and promptly to the event.

38.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Employer.

39. Tax

39.1 The rates quoted by the Contractor shall be deemed to be exclusive of the sales and other taxes that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.

40. Price Adjustment:

NA

41. Liquidated damages

41.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the Contract Data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.

41.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Employer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment of bill.

42. Advance Payments:

42.1 The Employer shall make payment to the Contractor of the amounts stated in the Contract Data by the date stated in the Contract Data, against provision by the Contractor of an unconditional bank guarantee in a form acceptable to the Employer issued by a Nationalized/Scheduled Bank in amounts equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest will not be charged on the advance payment.

42.2 The Contractor is to use the advance payment only to pay for Mobilization expenses required specifically for execution of the Works. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Employer.

42.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuation of the work done, variations, price adjustments, compensation events or liquidated damages.

43. Securities:

43.1 The Security deposit (including additional security for unbalanced tenders) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and type of instrument acceptable to the Employer. The Security deposit shall be valid until a date 30 days from the date of expiry of Defects Liability Period and the additional security for unbalanced tenders shall be valid until a date 30 days from the date of issue of the certificate of completion.

44. Cost of Repairs:

44.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

E. Finishing the Contract

45. Completion

45.1 The Contractor shall request the Employer to issue a Certificate of Completion of the Works and the Employer will do so upon deciding that the Work is completed.

46. Taking over

46.1 The Employer shall take over the Site and the Works within seven days of issuing a certificate of Completion.

47. Final account

47.1 The Contractor shall supply to the Employer a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Employer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 90 days of receiving the Contractor's account if it is correct and complete. If it is not, the Employer shall issue within 90 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Employer shall decide on the amount payable to the Contractor and make payment within 60 days of receiving the Contractor's revised account.

48. As built drawings and /or Operating and Maintenance Manuals

48.1 If "as built"[6]Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract Data.

48.2 If the Contractor does not supply the Drawings by the dates stated in the Contract Data, or they do not receive the Employer's approval, the Employer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

49. Termination

49.1 The Employer may terminate the Contract if the other party causes a fundamental breach of the Contract.

49.2 Fundamental breaches of Contract include, but shall not be limited to the following:

(a) the Contractor stops work for 45 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Employer;

(b) The Contractor becomes bankrupt or goes into liquidation other than for a reconstruction or amalgamation;

(c) the Employer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Employer;

(d) the Contractor does not maintain a security which is required;

(e) the Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and

[6]Completion Drawings

(f) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in the executing the Contract.

For the purpose of this paragraph : "corrupt practice" means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Tenderers (prior to or after Tender submission) designed to establish Tender prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition."

49.3 When either party to the Contract gives notice of a breach of contract to the Employer for a cause other than those listed under Sub Clause 49.2 above, the Employer shall decide whether the breach is fundamental or not.

49.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

49.5 If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site as soon as reasonably possible.

50. Payment upon Termination

50.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Employer shall prepare bill for the value of the work done less advance payments received up to the date of the bill, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be a debt payable to the Employer.

50.2 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Employer shall prepare bill for the value of the work done, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works and less advance payments received up to the date of the certificate, less other recoveries due in terms of the contract, and less taxes due to be deducted at source as per applicable law and make payment accordingly.

51. Property

51.1 All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of a Contractor's default.

52. Release from performance

52.1 If the Contract is frustrated by any event entirely outside the control of either the Employer or the Contractor the Employer shall certify that the Contract has been

frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made.

F. Special Conditions of Contract

1. Labour :

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

The Contractor shall, if required by the Employer, deliver to the Employer a return in detail, in such form and at such intervals as the Employer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Employer may require.

2. Compliance with labourregulations :

During continuance of the contract, the Contractor and his sub contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, Employer shall have the right to deduct any money due to the Contractor including his amount of security deposit. The Employer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

3. Protection of Environment:

The contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation. During continuance of the contract,

the contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made there under, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.

4. Arbitration (Clause 24)

4.1 The procedure for arbitration shall be as follows:

(a) In case of dispute or difference arising between the Employer and the Contractor relating to any matter arising out of or connected with this agreement it shall be settled in accordance with the Arbitration and Conciliation Act 1996. The disputes or differences shall be referred to a Sole Arbitrator. The Sole Arbitrator shall be appointed by agreement between the parties; failing such agreement, by the Appointing Authority (any one of the Organizations as per list enclosed in Annexure)

(b) Arbitration proceedings shall be held at ***Bangalore***, Karnataka, India

(c) The cost and expenses of arbitration proceedings will be paid as determined by the Arbitrator. However the expenses incurred by each party in connection with the preparation, presentation, etc., shall be borne by each party itself.

(d) Performance under the contract shall continue during the arbitration proceedings and payments due the Contractor by the Employer shall not be withheld, unless they are the subject matter of the arbitration proceedings.

5 Contractor to Co-ordinate his Work with Other Contractors

5.1 The Contractor has to co-ordinate with the other concerned Contractors as already specified in Conditions of Contract for all such works as per the directions of Engineer in charge at no extra cost.

6 **Continuation of Work:**

6.1 In case of the death of a contractor after executing the agreement / commencement of the work, his legal heir, if any eligible registered contractor and willing, can execute and complete the work at the accepted tender rates irrespective of the cost of the work

7. **<u>Further the following conditions will also become part of the agreement which may please be noted</u>.**

a) Rates quoted by the contractor/firm is exclusive of all taxes and duties.
b) The Contractor/Firm should mandatorily pay by themselves the necessary Entry Tax & other applicable taxes without fail.
c) All applicable taxes payable in respect of work shall be paid by the contractor / firm to the necessary departments.
d) Any Outstanding amount in the form of taxes be paid including interest, penalty etc.,

e) Details of Taxes recovered in the bills shall be collected in the prescribed forms from time to time.
f) Materials purchased with regards to work contract, the Board will not issue e-Sugam numbers.
g) Exemption of Excise duty, custom duty and any other claimed by the contractor / firm while purchasing material required for the work should be refunded to the Board or otherwise such amount will be recovered from the contractor / firm bills if not paid to the Board.
h) All taxes payable in respect of work shall be paid by the contractor / firm and Board is not responsible for this.
i) After the 100% replacement of pipeline along with other works,UFW level has to be ascertained in the DMA area and the report has to be submitted to this office.
j) Any clarification required in this regard shall be obtained from this office during office hours.

Annexure:

LIST OF ORGANIZATIONS WHO ARE CONSIDERED AS APPOINTING AUTHORITY FOR APPOINTMENT OF ARBITRATORS[32]

1. Indian Council of Arbitration, New Delhi;
2. International Centre for Alternative Disputes Resolution (India);
3. Indian Roads Congress;
4. Indian Building Congress;
5. Indian Institute of Bridge Engineers;
6. Indian Institute of Public Health Engineers;
7. Institute of Water Works

[32] Add any other Organization considered suitable.

SECTION 6:

CONTRACT DATA

CONTRACT DATA

Items marked "N/A" do not apply in this Contract.

The following documents are also part of the Contract:	Clause Reference
• The Schedule of Operating and Maintenance Manuals	[48]
• The Methodology and Program of Construction	[25]
• Site Investigation Reports	[14]
• The Schedule of Key and Critical Equipment to be deployed on the work as per agreed program of construction.	[25]

The Employer is :

Name: ***Engineer-in-Chief, BWSSB.*** [1.1]

Address: ***2nd Floor, Cauvery Bhavan,***
Kempegowda Road,
Bangalore 560 009
Ph: 080-22945105

Name of authorized Representative: **Executive Engineer, UFW-2, Malleshwaram, Bangalore**

The name and identification number of the Contract is : **Tenderfor the Work of Modernization of existing network & reduction in Non-Revenue Water in Annayyappa Block DMA coming under AEE(NE)-2 Sub-Division limits of BWSSB, Bangalore.**

The Works consist of Laying of 100mm,150mm,200mm,250mm&300mm dia DI K9 and406mm dia MS water supply pipe line with inner lined with cement mortar, Manufacturing, providing, transporting, jointing, testing & commissioning of 100mm to 300mm diaDI specials, MS specials, providing & fixing of100mm to300mm dia sluice valves, linking work including MS, MJ specials if necessary to suit the site condition, CPVC HSCs, CWMS.Suppy,installation& commissioning of EMF bulk flow meters.

The start date shall be the date of issue of notice to proceed with the work. [1.1]
The Intended Completion Date for the whole of the Works is **Six*(06) Months***with the following milestones [17, 26]

Milestone dates:

	Physical works to be completed	Period from the date of issue of Notice to proceed with the work
Milestone 1	Complete work as per the BOQ	06 months

The Site Possession Date is: [21]

The alignment is located Annayyappa BlockDMA coming under AEE(NE-2)sub Divisionarea [1.1]
and is defined in drawings nos.

Payment Terms.
The employer will make the payment to the items of pipelines on the following terms-(Clause 43 GCC)
DI Pipes

55% of the contract price	After supply of DI pipes to site of work
15% of the contract price	After laying of DI pipes.
10% of the contract price	After certification of Hydraulic testing of DI Pipeline.
10% of the contract price	After Completion and commissioning of DI Pipeline work including delinking of existing pipeline.
10% of the contract price	After Road restoration

Valves

50% of the contract price	After supply of Valves to site of work
25% of the contract price	After fixing in pipeline.
25% of the contract price	After successful commissioning of work

EMF Bulk Flow Meters

50% of the contract price	Upon Supply of Electro Magnetic Bulk Flow Meters at t each location.
45% of the contract price	Upon Installation, successful Testing and Commissioning of Electro Magnetic Bulk flow meters and synchronizing readings from all bulk flow meters to available central server..
5% of the contract price	Upon successful completion of 1 year Defect Liability Period.

For all specials, 80% of the payment will be made only after supplying, laying, fixing at site and balance 20% after commissioning.

The Defects Liability Period is **365** days [31]

Insurance requirements are as under: [13]

Type of Cover		Rs.100.00 lakhs
(i)	Works and of Plant and materials	The sum stated in the Agreement plus 20%
(ii)	Loss or damage to equipment	Full replacement cost
(iii)	Loss or damage to property of Third Party	Full replacement cost
(iv)	Personal injury or death insurance (a) for Third Party	At the risk of the tenderer as per the Rules of Labour Department.
	(b) for Contractor's employees or labour	In accordance with the statutory requirements applicable to Karnataka

The liquidated damages for the whole of the works are
Rs. 0.1% per day[7] and that for the milestones are as under:

The maximum amount of liquidated damages for the whole of the works is ten percent of final contract price. [41]
[50.1]

[7]Amount shall be corrected at the time of agreement. Shall be 0.1% of the Contract price

SECTION 7:

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

I GENERAL

1.1 Scope of Work.

The scope of work under this Contract includes the following:

1.1.1 Supply, Laying, testing &commissioning of100mm,150mm,200mm,250mm & 300mm dia DI K9 and 406mm dia MS water supply pipe line with inner lined with cement mortar,

1.12 Providing, transporting, testing & commissioning of 100mm to300mm dia DI specials and 406mm dia MS Specials.

1.1.3 Earthwork in all kinds of soil, hard rock. The pipeline is to be laid in the developed city roads with traffic

1.1.4 Fixing and connecting all pipelines fixtures like valves, bends, tees and other specials as specified in the construction drawings, construction all appurtenant structures such as pipe supports, valve chambers, thrust blocks, etc., Providing House service connections etc

1.1.5 Backfilling the trenches, restoring and making good all surfaces which are damaged during excavation.

1.1.6 Dismantling and reconstruction of structures such as culverts, storm water drains, roads etc., and utility lines such as water supply pipe lines, sewer lines coming in the way of the pipeline alignment.

1.1.7 Testing and commissioning of the pipe line after laying, HSC.

1.1.8 All work shall be done as per the specifications. The works shall include providing all materials, equipments, labour, tools, plants, transport etc., and all other services necessary for the complete construction including necessary sub-soil investigations.

1.20 The alignment of the pipeline and other typical details of pipe bedding, valve chambers, thrust blocks, pipe supports, and the general arrangement of reservoir are furnished in Drawings. Further details shall be furnished in the construction drawings during the construction stage if found necessary.

1.21 Providing and laying HSC,CWM

1.22 After the 100% replacement of pipeline along with other works,UFW level has to be ascertained in the DMA area and the report has to be submitted to this office.

1.2 Royalties

1.2.1 The Employer shall deduct Royalties on materials used in the Works from the progress payments to the Contractor at the rates specified in the most recent "Amendment to the Karnataka Minor Minerals Concession Rules - 1969" as published by the Commerce and Industries Department (Mines) and as illustrated in Annexure-1, attached.

1.3 Site Order Book

1.3.1 The Contractor shall maintain an identical pair of Site Order Books (one marked original and the other marked duplicate), at the Site at all times during the execution of the Works for the use of the Engineer and the Contractor. All instructions issued by the Engineer to the Contractor shall be recorded in both sets of the Site Order Book and shall be signed by the issuer and countersigned by the Contractor. After compliance with the instruction, the Contractor shall record the same in both sets of the Site Order Book duly signed and countersigned by the Engineer. Acceptance of any part of the work executed by the Contractor shall be subject to verification with respect to compliance of respective instructions of the Engineer through the Site Order Book. The Engineer shall retain the original copy of the Site Order Book, while the Contractor shall retain the duplicate one.

1.4 Quarry Materials

1.4.1 The Contractor shall be wholly responsible to identify the suitable sources for quarry materials required for the Works, such as earth, sand, stone, muram, etc., and to make his own arrangements for collection and transportation of the materials irrespective of the leads and lifts required. The quarry thus identified by the Contractor should have proper license from the Government of Karnataka. All materials supplied by the Contractor shall satisfy the requirements set forth in the Specifications and shall be subject to the approval of the Engineer. The Contractor shall take this into account while offering his rates and no claims whatsoever shall be entertained for extra costs on this account.

1.5 Inspection and testing

1.5.1 Inspection of Material to be procured

Inspection and certification of all materials used on the works such as MS Plates / Pipes and Specials , Valves, Cement, Size Stones, Sand aggregate, Lead, Rubber gaskets etc., for conformity with specifications of BIS. If insisted, inspection of materials at the manufacture place shall be arranged by the contractor at his cost including the travelling and accommodation of the inspecting officer.

1.5.2 **Inspection and certification of the various components of works.**

Construction of MS pipeline with all fixtures, construction of Valve Chamber including back filling of trench in layers with compaction as specified to ensure that all components of works are carried out as per specification and to required standards.

Inspection & Certification of Hydraulic Test on Completed pipe line in reaches as specified.

1.6 Technical Specifications

1.6.1 Engineer shall have the right to modify/alter the Particular Specifications and/or Standard Specifications at any time which promise to confer equal or better

quality than the standard specified in the tender document. Such modification or alteration shall be acceptable to the Contractor subject to no additional financial burden to either the Contractor or the Employer.

1.7 Storage of Materials and Plant

1.7.1 The Contractor shall provide appropriate storage facilities for materials like cement, steel, aggregates, consumable supplies, equipment, mechanical and electrical items, etc., and shall take all safety and security measures against theft and deterioration in quality, at his own cost.

1.8 Procurement of Materials:

1.8.1 CEMENT:

The Contractor shall use only 43 grade cement conforming to IS 8112 / 89 with latest amendments with ISI mark. The Contractor should furnish the manufacturer test certificate for the above brand of cement for having manufactured the cement as per relevant BIS and guarantee certificate before using the cement.

1.8.2 STEEL:

The Contractor shall procure the steel from VISL / SAIL / VSP / TISCO and manufacturers' test certificate is to be produced.

1.8.3. DI PIPES and D.I. Specials.

Sl.No.	**Description**	**Make**
1	DI Pipes	Electrosteel, LancoKalahasti, Jindal SAW, Tata, Sathavahana
2	DI Specials	Electrosteel, Kiswok, Kezrival Castings Ltd.,Zindal

(Any other reputed make as may be approved by BWSSB at a later date by producing the credentials.)

The above branded makes are preferred. In the bid the bidder should specify the make for which the rate is quoted without which the Board can specify any make among the above brands.

1.9 Equivalency of Standards and be procured, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be acceptable subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents.

1.10 Sign Board

1.10.1 The Contractor shall provide a sign board at the site of the Works of approved size and design which provides (i) the name of the Project (ii) the names and addresses of the Employer, the Contractor and the Consultant; (iii) the name and short description of the Project, (iv) the amount of the Contract Price ; and (v) the starting and completion dates.

1.11 Samples and Tests

1.11.1 The Contractor shall be responsible to develop a quality control program and to provide all necessary materials, apparatus, instruments, equipment, facilities and qualified staff for sampling, testing and quality control of the materials and the works under the Contract. Without limiting the generality of the foregoing, the Contractor shall either (i) establish a testing laboratory at the site of Works which is adequately equipped and staffed to carry out all sampling and testing in accordance with the requirement set out in the General Specifications and/or these Special Specifications and provide all field equipment and apparatus as necessary to conduct all specified in-situ tests and/or any Tests on Completion, provided the correctness of the equipments are ensured or (ii) arrange for routine sampling, testing and reporting, as required, through a certified independent testing laboratory acceptable to the Engineer. All costs of such sampling, testing and reporting of test results will be borne by the Contractor, and the Contractor shall include sufficient provisions in his tendered rates to allow for independent sampling and laboratory testing under the direction of the Engineer up to 5% of the required tests at no additional cost. The Contractor shall furnish certified copies of all test reports to the Engineer within 3 days of completion of the specified tests.

1.11.2 The Contractor shall, within 14 days after the date of the Letter of Acceptance, submit to the Engineer for his consent a detailed description of the arrangements for conducting the quality control program during execution of the Works, including details of his testing laboratory, equipment, staff and general procedures. If following submission, or at any time during the progress of Works, it appears to the Engineer that the Contractor's quality control program is not adequate to ensure the quality of the Works, the Contractor shall produce a revised program which will be adequate to ensure satisfactory quality control.

1.12 Protection of Utilities

1.12.1 The Contractor is required to carefully examine the location of the Works and their alignments and to make special enquiries with all authorities concerning all utility lines such as water, sewers, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead) lines, etc.; and to determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Contractor shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required, and shall not make any claim for extra work or extra time that may be required to protect or facilitate relocating such utilities. If any major shifting or realignment of water, sewers, gas pipes, electric and telephone lines is necessary due to their interference with the proposed Works, the same may be done by the Employer. The cost of such relocation will be borne by the Employer. In case the alignment of the pipeline crosses high tension electrical transmission lines belonging to the

Karnataka Power Transmission Corporation Ltd. (KPTCL) or other authorities, the Contractor shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Contractor will be responsible to carry out all construction activities in such reaches in consultation with the owners of such facilities. However, satisfactory completion of the entire work will be the responsibility of the Contractor.

II EARTH WORK:

2.1 GENERAL:

2.1.1 The earth work excavation for laying of pipe shall be carried out. The Contractor shall make all excavations required for laying and jointing of the pipeline and construction of pertinent structures as required in the project. Except where otherwise required by the project or instructed by the Engineer, all excavation shall be in open cut to the specified widths and depths. The Contractor is advised to satisfy himself with regard to the likely conditions that may be met with during the execution of the Works, with regard to the underground obstructions or conditions, necessary dewatering requirements etc. Before commencing the earth work, the Contractor shall carry out detailed survey of the proposed alignment, prepare construction drawings showing the longitudinal section of the ground profile, locations of valves and other appurtenances and submit to the Employer for approval.

2.2 CLASSIFICATION OF EXCAVATION

All materials involved in excavation shall be classified in three categories as follows:

2.2.1 **Ordinary soil:** This includes excavation in all types of soil including soil containing gravels, murums, loose boulders, viz., ordinary gravely soil, hard gravely soil, wet soil, stiff slushy soil, chettu soil and calcareous strata, but exclusive of disintegrated rock, soft rock/shale;

2.2.2 **Soil Containing Disintegrated Rock, Soft Rock and Soft Shale:** This category includes excavation in soil containing disintegrated rock, soft rock or soft shale which can be cut by shovel and no hand or mechanical chiseling is required.

2.2.3 **Medium Hard Rock:** This category includes excavation in lime stone, sand stone, hard shale and schist fissured rock, without resorting to blasting.

2.2.4 **Hard Rock:** This category includes excavation in hard rock requiring hand or mechanical chiseling or blasting. In case of difference in opinion between the classification of rock requiring blasting and that requiring chiseling, wedging, the site of work shall be inspected by the engineer and the decision of the Engineer shall be final and binding on the Contractor.

2.3 LIMITATION OF EXCAVATION

2.3.1 The trench for laying MS Spiral welded pipes shall have minimum width as per standards stipulated or as directed by the Engineer-in-charge. A minimum earth

cover of 1.2 m shall be maintained above the pipe top, unless otherwise specified or shown in the alignment drawings.

2.3.2 The Contractor shall be responsible to ensure that the widths and depths of the trenches do not exceed the limits shown in the construction drawings. Should the excavation occur beyond the dimensions specified therein, because of the negligence of the Contractor, the Contractor shall fill the excess space with granular material or concrete as directed by the Engineer. Nothing extra shall be paid to the Contractor on account of this.

2.4 TRAIL PITS

2.4.1 Trial pits may be dug by the Contractor, without being directed to do so, along the alignment as shown on the drawings in advance of the excavations for the purpose of satisfying himself as to the location of under ground obstructions or soil conditions.

2.5 SLIPS AND SLIDES

2.5.1 The Contractor is responsible for proper protection of excavations made by him from any slips and slides. All slides and caving shall be handled, removed or corrected by the Contractor without any extra compensation at whatever time and under whatever circumstances they may occur. The excavations shall be made good and brought to necessary depth, width and levels without any extra cost.

2.6 STCKING OF EXCAVATED MATERIALS

2.6.1 The excavated material shall be stacked on the sides of the trench wherever possible. Wherever it is not possible to stock on the sides of the trench, contractor has to find the place nearby for stocking the excavated material and cart the materials to &fro. Rate for this shall be included in the earthwork itself and no extra rate will be paid for this.

2.6.2 Surplus earth is to be disposed off to a place identified by the contractor approved by the engineer. There is a item for this work and will be paid accordingly.

2.7 Safety measures

The Contractor shall provide adequate safety measures during excavation. They shall include:

1. Barricading all sides of the open trenches.
2. Red danger lights which can be easily visible from dusk to dawn placed at an interval of 20 m.
3. Traffic signals and display boards giving direction for diversion of traffic at the appropriate places as may be directed by the Engineer.
4. Adequate safe wooden plank / board or steel plate over the trenches to facilitate crossing by the public residing on either side of the trench.
5. Round the clock watch and ward maintaining all safety regulations at the site of work and protecting the site from unauthorised intrusions.

2.8 Progress of Excavation of pipe trenches

The Contractor shall adjust excavation of trenches in such lengths that the pipes can be laid in such exposed portion of the trench within 2 days.

2.9 Shoring and Bracing

The Contractor shall supply, fix and maintain necessary sheathing, shoring and bracing etc., in steel or wood, as may be required to support the sides of the excavation, to protect workmen in the trench and to prevent any trench movement which might any way injure or delay the work, change the required width of the trench, make unsafe condition for adjacent pavements, utilities, buildings or other structures above or below ground.

Sheathing, shoring and bracing shall be withdrawn and removed as the backfilling is being done, except when the Engineer may agree that such sheathing, shoring and bracing be left in place, at the Contractor's request. In any case, the Contractor shall cut off any such sheathing at least 600 mm below the surface and shall remove the cut off material from the trench.

All sheathing, shoring and bracing which are left in place under the foregoing provisions shall be removed in a manner so as to not endanger the completed work or other structures, utilities or property, whether public or private.

2.10 EXCAVATION

2.10.1 Excavation in Rock

Excavation in rock shall be carried out to a depth, 150 mm more than the bottom level of pipe and to a width equal to the diameter of the pipe plus minimum working space on either side as given in drawing. Unless otherwise directed by the Engineer, rock excavation shall be progressed at least by 50 m in advance of the pipe length proposed to be laid.

2.10.3 Excavation for Valve Chambers and Other Appurtenant Structures

The Contractor shall excavate as required for all structures with foundations to firm, undisturbed earth up to the level of the under side of the structure. If the excavation is in rock, the Contractor shall excavate all rock at least to the minimum limits shown on the standard details for trenches and to the grade of the bottom of inlets, junction chambers or other structures as required. Where the bottom of the structure is in rock, it should be ensured that no rock shall project above the lower surface of the concrete in such a manner so as to reduce the required thickness of concrete placed simultaneously as an integral part of the foundation and to the outside of structure foundation where structure is to be built. The Contractor shall excavate the trench / pit to provide necessary working space on all sides and for accommodating any sheathing, shoring or bracing etc.

2.11 Contractor's Responsibility

The Contractor shall be responsible for the adequate pumping, drainage and bailing out water from the excavated trench. In case of failure to make such

provisions or any other provisions which may result in unsuitable sub-grade conditions, the Contractor shall replace and repair the sub-grade as directed to the satisfaction of the Engineer, at his own cost and responsibility.

Should the Contractor select to use a gravel sub-grade to facilitate flow of water to pumps or other points of disposal, such gravel sub-grade shall not be measured or paid for as an extra item.

2.12 Works Included in Excavation

The following works as per specifications are also included in excavation and the term 'Excavation' shall construe to mean all such items of work. The quoted rates should include the same:

1. Provision of side space or additional space in the trench/pit for working and/or accommodating sheathing, shoring, bracing, etc.
2. Supply, installation and removal after the work, all sheathing, shoring and bracing required to protect the excavation where required or where such work is recommended by the Engineer.
3. Protection of excavations.
4. Providing adequate safety measures.
5. Additional work in connection with overhead wires and poles.
6. Excavation for Socket hallows.
7. Supplying and fixing of sight rails and boning rods in the trench to facilitate measurement of work.

2.13 Measurement and Payment for Excavation

2.13.1 For Excavation

The measurement for excavation shall be considering the allowable widths, depths with allowed side slopes (if any) for different classes of soils as per approved classification. The measurement for excavation shall be based on "neat line" dimensions as specified in the drawing or Specifications, for different types of soils and depth of excavation. The total volume of excavation shall be computed as a square bottomed trench of width equal to the outer diameter of the pipe, with minimum working space as given in the drawing, added to it, length up to the length of the trench being measured. The depth of trench being average depth taken at 30 m intervals, between the level of bottom of trench and the original surface of the ground. The length of the trench shall be measured as per the actual length of pipes and fittings / specials laid at work site. However depth shall be measured at closure intervals at vulnerable places. The volume of excavation for structures like valve chambers, thrust blocks and anchor blocks etc., shall be computed and measured for payment as per the bottom area of the particular structure on outer periphery multiplied by the average depth between the level of the finished bottom of the structure and the original surface of the ground. The quantity shall be measured in cubic meters correct to two decimal places. The method of measurement for excavation in different classes of soils shall be as follows:

2.13.2 In Ordinary Soil and Soil Mixed with Disintegrated Rock and Soft Rock / Shale

In this category of soils, the excavation quantity shall be computed as specified above.

2.13.3 In Hard rock

In case of hard rock requiring chipping or chiseling, measurements shall be taken prior to and after chiseling and the volume of rock excavation shall be measured based on this difference. The excavation in rock shall be paid on stack measurements with a deduction of 40% in volume for voids.

2.13.4 For Excavation in Combination of Ordinary Soil, Disintegrated Rock, Soft Rock/Shale and Hard Rock/Schist

Wherever the excavation is undertaken in combination of ordinary soil, disintegrated rock, soft rock /shale and hard rock, the hard rock part shall be measured and paid, the soil part shall be measured and paid for the total measurable excavated quantity deducting the quantity measured for the hard rock. The total computed volume of excavation shall be equal to the sum of the computed volumes for each category of excavation undertaken.

2.14 Protection of Utilities

The Contractor is required to carefully examine the location of the Works and their alignments and to make special enquiries with all authorities concerning all utility lines such as water, sewers, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead) lines, etc.; and to determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Contractor shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required, and shall not make any claim for extra work or extra time that may be required to protect or facilitate relocating such utilities. If any major shifting or realignment of water, sewers, gas pipes, electric and telephone lines is necessary due to their interference with the proposed Works, the same may be done by the Employer. The cost of such relocation will be borne by the Employer.

In case the alignment of the pipeline crosses high tension electrical transmission lines belonging to the Karnataka Power Transmission Corporation Ltd. (KPTCL) or other authorities, the Contractor shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Contractor will be responsible to carry out all construction activities in such reaches in consultation with the owners of such facilities. However, satisfactory completion of the entire work will be the responsibility of the Contractor.

III BEDDING.

3.1. Bedding for the pipe

Bedding shall be provided all along the stretch of the pipe line, which differs based on the area through which the pipe line passes. However, the type of bedding to be provided shall be as decided by the Engineer.

3.2 Earth Bedding

The pipes shall be placed on the natural, undisturbed earth bedding, which has been carefully shaped to fit the lower part of the pipe for a width of at least 50 % of its external diameter. The trench shall be excavated to an extra breadth and depth, wherever weld joints are coming. Filling and removing earth or similar materials beneath the pipe to adjust with the grade will not be permitted except filling with compacted granular bedding material or murrum.

3.3 Gravel Bedding

Wherever rock is met with, it shall be removed up to 150 mm below the bottom level of the pipe to a minimum width equal to the width of the trench and the resulting space shall be filled up with good quality compacted gravel. The granular material shall be filled in the trench up to the level of ¼ the outer diameter of the pipe line, above the bottom of trench and well compacted. Unless otherwise directed by the Engineer, rock excavation shall progress at least 20 m in advance of the pipe length proposed to be laid.

3.4 Measurement for bedding:

The Contractor shall include the cost of earth bedding required for the pipeline in the tendered rate for pipe laying, for providing gravel bedding. The surplus quantity of excavated earth shall be disposed off. The quantity shall be measured in cubic meter correct to two decimal points.

IV BACK FILLING

4.1 General

The Contractor shall use selected surplus spoils from excavated materials for backfilling. All fill material shall be subject to Engineer's approval. The excavated materials suitable for backfilling shall be stored not closer than 600 mm from the edge of the trench and shall not obstruct any public utilities or interfere with travel by local inhabitants or general public. Handling and storage of excavated materials must meet with the regulations of the Local Government Authorities. The detailed specifications for backfilling shall be as per Clause 8 of IS: 3114-1994 and Clause 4.11 of IS 12288-1987.

4.2 Method of Backfilling

Trenches and excavated pits for structures shall be backfilled to original ground level or to such other levels, as the Engineer may direct. All backfilling shall be carried out in orderly manner expeditiously and consistent with good workmanship.

4.2.1 Backfill material put into the trenches/pits for backfilling, shall unless otherwise specified be compacted and built up as to minimise future settlement as much as is reasonably possible. For this, care shall be exercised in selecting backfill material free from large hard clay lumps, especially in cramped areas directly adjoining the walls of structures.

4.2.2 Backfilling in trenches shall be done as pipe laying progresses, with the permission of the Engineer, after the pipe or conduit is properly bedded, jointed and inspected and all measurements for the location of Y-Junctions, tees, etc., are properly recorded by the Engineer and sufficient time is allowed for the joint materials or cement concrete or mortar to set. However the joints shall be left open for inspection during testing, which shall be backfilled after successful completion of testing, after obtaining permission from the Engineer. Backfilling around and over the pipe, conduit, or structure shall be taken up uniformly on all sides and in the sequence and manner specified hereinafter, with care to avoid the displacement or damage to the pipe, conduit or structure. For the purpose of backfilling, the depth of trench shall be divided into the following three zones measured from bottom to top of trench, as follows:

i. Zone A : From bottom of trench to the centre line of pipe,
ii. Zone B : From the level of centre line of pipe to a level of 300 mm above the top of pipe,
iii. Zone C : From a level of 300 mm above the top of pipe to the top of trench.

4.2.3 Backfilling in the trenches and around structures shall be carried out in horizontal layers of uniform thickness of not more than 150 mm when measured loose. As may be necessary to attain maximum compaction, the backfill material shall be moistened by sprinkling with water. After placing each layer of backfill material, the layer shall be thoroughly and uniformly compacted by means of mechanical or hand tampers. The compacting equipment and the manner of its use shall be subject to the approval of the Engineer.

4.2.4 After the backfill material is placed in Zone A and Zone B as specified above, the remaining portion i.e., Zone C of the trench may be machine backfilled. Even in this case the backfill material shall be placed in uniform horizontal layers of not more than 150 mm thickness. Small pebbles of size less than 50 mm, if any, shall be so distributed throughout the mass, that all interstices are solidly filled with fine material. The backfill material shall be tamped with mechanical tamping equipment, after moistening the backfill by sprinkling with water to obtain maximum compaction (min 95% proctor density).

4.2.5 Machine backfill shall be so conducted that the material deposited in the trench shall not fall directly on top of the pipe from such a height as might result in damage to the pipe joints or alignment.

4.2.6 If the trench is subjected to conditions which might cause flotation of the pipe before sufficient backfill has been placed, the Contractor shall take the necessary precautions to prevent floatation of the pipe, conduit or structure.

4.2.7 Before final acceptance of the work, additional tamped earth shall be added to restore the settled trench surface to the required level of the adjacent earth surface or to the base of crushed rock wearing surface or to the finished earth base.

4.2.8 If from the excavated soil, enough backfill material is not available, imported, selected and approved backfill material from the borrow pits is required to be placed for backfill, on approval of the Engineer backfilling of trenches where the excavation is in the rock shall be with the surplus soft soil, with all lead and lift.

4.3 Disposal of Surplus Excavated Material

The excavated material which is in surplus to the requirements after backfilling shall be removed and spread at places shown by the Engineer, with all lead and lift from the site of work, for which payment shall be made as per the quoted rates. No surplus or excess material shall be disposed in a stream / channel or in any place where the pre-construction surface drainage may have to be provided, without written permission of the Engineer.

V DUCTILE IRON PIPELINE

5.1 Scope

This specification covers the requirements for manufacturing, supplying, laying, jointing, testing and commissioning of Ductile Iron pipeline and fittings including associated civil works required for the same.

5.2 Standards

The following specifications, standards, and codes are part of this specification. All standards, specifications and codes of practice referred herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern,

IS:8329	Centrifugally Cast (Spun) ductile Iron Pressure pipes for water, gas and sewage.
IS:638	Sheet rubber jointing and rubber insertion jointing.
IS:1387	General requirements for supply of metallurgical materials**.**
IS:1500	Methods for Brinell Hardness test for metallic materials.
IS:9523	Ductile Iron fittings for pressure pipes for water, gas and sewage.
IS:12820	Dimentional requirements of rubber gaskets for mechanical joints and push on joints for use with cast iron pipes and fittings for carrying water, gas and sewage.
ISO:4179	Ductile iron pipes for pressure and nonpressure – Centrifugal cement mortar lining – General requirements.
ISO:2531	Ductile iron pipes, fittings and accessories for pressure pipe lines.
IS:5382	Specification for Rubber Sealing rings for Gas mains, water mains and sewers.
AWWA C600	Installation of ductile iron water mains and their appuratenances.

IS:11906 Recommendations for cement-mortor lining for cast iron, mild steel and ductile iron pipes and fittings for transportation of water.

IS:3764 Excavation work – code of safety.

IS:12288 Code of practice for use & laying of Ductile iron pipes.

IS:460 Test sieves – Part I

IS:8112 Specification for 43 Grade Ordinary Portland Cement.

BS 3416 Bitumen based coatings for cold application, suitable for use in contact with potable water.

BS EN 545 Ductile iron pipes, fittings, accessories and their joints for water pipelines – requirements and test methods.

ISO 81790 For zinc coating.

5.3. Manufacture of pipe

DI pipes and fittings (Class K9) shall be in accordance with IS: 8329 and IS: 9523. Pipes and fittings shall be procured from reputed manufacturers with Engineer's approval. Engineer shall at all reasonable times have free access to the place where the Pipes and fittings are manufactured for the purpose of examining and testing the pipes and fittings and for witnessing the test and manufacturing.

All tests specified either in this specification or in the relevant Indian Standards specified above shall be performed by the Manufacturer / Contractor at his own cost and in presence of Engineer if desired. For this, sufficient notice before testing of the pipes and fittings shall be given to Engineer.

If the test is found unsatisfactory, Engineer may reject any or all pipes and fittings of that lot. The decision of Engineer in this matter shall be final and binding on the Contractor and not subject to any arbitration or appeal.

The pipes and fittings shall be stripped, with all precautions necessary to avoid warping or shrinking defects. The pipes and fittings shall be free from defects. Any defect in pipes and fittings in the opinion of Engineer shall be rejected and shall be replaced by new one.

In the case of spigot and socket pipes and fittings, the socket shall be without the centre ring.

In the case of flanged pipes, the flanges shall be at the right angles to the axis of the pipe and machined on face. The bolt holes shall be drilled and located symmetrically off the centre line. The bolt hole circle shall be concentric with the bore and bolt holes equally spaced. The flanges shall be integrally cast with the pipes and fittings and the two flanges of the pipe shall be correctly aligned.

a). Materials

The materials used in the manufacture of pipes and fittings shall comply with requirements specified in IS: 8329 - 2000 and IS: 9523 - 2000.

b). Dimensions and Tolerances

The internal diameter, thickness and length of barrel, dimensions of pipes and fittings shall be as per relevant tables of IS: 8329/IS: 9523 for different class of pipes and fittings. Pipe of standard length of 6m is recommended and other properties for pipes and fittings shall be as per IS: 8329/IS: 9523. Each pipe shall be of uniform thickness throughout its length.
The tolerances for pipes and fittings regarding dimensions, mass, ovality and deviations from straight line in case of pipes shall be as per IS: 8329/IS: 9523.

5.4 Testing

(a) **Mechanical tests**

Mechanical tests shall be carried out during manufacture of pipes and fittings as specified in IS: 8329/IS: 9523. The frequency and sampling of tests for each batch of pipes shall be in accordance with IS 8329. The tests results so obtained for all the pipes and fittings of different sizes shall be submitted to Engineer. The method for tensile tests and the minimum tensile strength requirement for pipes and fittings shall be as per IS: 8329/IS: 9523.

(b) Brinell Hardness Test

For checking the Brinell hardness, the test shall be carried out on the test ring or bars cut from the pipes used for the ring test and tensile test in accordance with IS 1500. The test shall comply with the requirements specified in IS 1500/IS 8329.

(c) **Retests**

If any test piece representing a lot fails in the first instance, two additional tests shall be made on test pieces selected from two other pipes from the same lot. If both the tests results satisfy the specified requirements, the lot shall be accepted. Should either of these additional test pieces fail to pass the test, the lot shall be liable for rejection.

(d) Hydrostatic Test

For hydrostatic test at works, the pipes and fittings shall be kept under test pressure as specified in IS 8329/IS9523 for a period of minimum 15 seconds, during which the pipes shall be struck moderately with a 700 g hammer for conformation of satisfactory sound. They shall with stand the pressure test without showing any leakage, sweating or other defect of any kind. The hydrostatic test shall be conducted before surface coating and lining.
During manufacture, tests on pipes shall be carried out in accordance with **clause 1.2.8of this Technical specification** by the Third party inspecting agency.

5.5 Jointing of pipes

(a) General

Jointing of DI pipes and fittings shall be done as per IS: 12288 and manufacturer's recommendations. After jointing, extraneous material, if any, shall be removed from the inside of the pipe. Rubber sealing rings/gaskets used for jointing shall conform to IS: 638, IS: 12820 and IS: 5382.

(b) Spigot and Socket joints

These shall have sockets, which are integral with the pipe and incorporate an electrometric rubber ring gasket conforming to IS: 12820.

The gaskets/sealant used for joints shall be suitable for water conveyance. In jointing DI pipes and fittings, the Contractor shall take into account the manufacturer's recommendations as to the methods and equipment to be used in assembling the joints. In particular the Contractor shall ensure that the spigot end of the pipe to be jointed is smooth and has been properly chamfered, so that the rubber ring as per IS: 12820 and IS: 5382 is correctly positioned in line, before the joint is made. The rubber rings and any recommended lubricant shall be obtained only through the approved supplier and as directed by the Engineer.

(c) Gaskets for Flanges

All gaskets used between flanges of pipes shall be of natural rubber conforming to IS: 638 of thickness 3 mm suitable for waste water conveyance and as specified by manufacturer.

(d) Flanged joints

These shall be of PN 1.0 rating and shall comply with dimensions and drilling details as specified in IS: 8329. These shall have isolation gaskets between the flanges, isolation sleeves around all bolts and isolation washers under all bolt heads and nuts. All material shall be supplied by a reputed manufacturer and shall be approved by the Engineer.

Each bolt should be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively. The recommended bolting torque to be followed for assembling flanges shall be as specified in manufacturer's instructions. The practice of fully tightening the bolts one after another is highly undesirable. The bolts shall be of mild steel unless otherwise specified. They shall be coated with coal tar epoxy coating after tightening.

5.6 Specials

Standard DI fitting shall be in accordance with IS:9523. Wherever standard DI specials are not available, they shall be manufactured and tested as per requirements with the approval of Engineer.

5.7 Coatings

i). General

Unless otherwise specified, DI pipes and fittings shall be coated with Bitumen in accordance with relevant IS specifications. All buried DI pipes and fittings shall also have factory or site applied polythene sleeving. Coating shall not be applied to pipe and fittings unless its surface is clean, dry and free from rust. Pipe coatings shall be inspected at site and any damage or defective areas shall be made good to the satisfaction of the Engineer.

ii). Bitumen coating

Bitumen coating shall be of normal thickness of 75 microns unless otherwise specified. It shall be cold applied compound complying with the requirements of relevant Indian standards, suitable for tropical climates, factory applied in accordance with the manufacturer's instructions.

Damaged areas of coating shall be repainted on site after removing any remaining loose coating and wire brushing any rusted areas of pipe.

iii). Cement mortar lining

All pipes and fittings shall be internally lined with cement mortar in accordance with relevant IS. The cement used shall be Sulphate Resisting Cement confirming to IS: 12330. No admixtures in the mortar shall be used without the approval of the Engineer. The curing shall commence immediately after completion of the mortar lining, shall not be later than 8 hours after mixing of mortar. The lining shall be kept continuously in moist condition for a period of minimum 14 days.
Pipe linings shall be inspected on site and any damage or defective areas shall be made good to the satisfaction of the Engineer.
Lining shall be uniform in thickness all along the pipe. The minimum thickness of factory applied cement mortar lining shall be as per IS: 11906.

5.8. Marking

Marking shall be done as per IS: 8329 and IS: 9523 or any other relevant IS codes approved by the Engineer. The following information shall be clearly marked on each pipe,

a). Internal diameter of pipe.
b). Class of pipe.
c). Date of manufacture and
d). Name of manufacture or his registered trade-mark or both.

5.9. Carting & Handling.
Carting and handling of D.I. pipes and fittings shall be in accordance with the clause 3.4. of GSW pipes specifications.

5.10. Trenching.
Trenching includes all excavation which shall be carried out either by hand or by machine and shall be carried out in accordance with all requirements of part-2 Earth work excavations clause 2.0 to 2.17.wherever a socket or collar of pipe or fitting / special occurs, a grip is to be cut in the bottom of the trench or concrete bed to a depth of at least 75 mm below the bed of the pipe so that the pipe may have a fair bearing on its shaft and does not rest upon its socket. Such grip shall be of sufficient size in every respect to admit the hand all round the socket in order to make the joint, and the grip shall be maintained clear, until the joint has been approved by Engineer.
Wherever D.I. pipes are laid over pillar supports for nala crossings etc. the pipes shall be placed as per the construction drawings and as directed by the Engineer In-charge.

The width of the trench shall be kept to a minimum consistent with the working space required and having regard to the safety of the trench, the method of laying and jointing the pipe and the need to avoid damage to pipe coating and so as to provide the minimum horizontal clearance as stated in the table below. The bottom of the trench shall be properly trimmed to permit even bedding of the pipeline.

The portion of the trench which extends from the formation level to not less than 300 mm above the crown of the pipe when laid in its correct position, shall, unless otherwise specified or ordered by the Engineer, be formed with vertical sides. The clearance

between the sides and bottom of the trench and the barrel of the pipe shall not exceed the following, inclusive of any allowances required for temporary trench supports:

Pipe Nominal Bore(mm)	Bottom Clearance(mm)	Side Clearance(mm)
350 to 600	200	300
> 600 to 800	200	350

The clearance at joints may be increased to allow the joints to be made and inspected, any proposed increase shall be approved by the Engineer.

All trenches deeper than 1.2 m shall have the trench walls battered or supported to ensure the safety of all persons working in the trench if required. The Contractor is to provide details of these arrangements for approval by the Engineer prior to any work being undertaken in such a trench.

No excavations with battered sides shall be made in roads, footpaths, private gardens, or within 10m of any buildings or other structures.

The Contractor shall erect temporary fencing around all open excavations and post warning signs in English and the local language. All fencing shall be at least 1 m tall, rigid in nature and strong enough to prevent people falling into the trench. The Contractor shall also take all other necessary measures to ensure the safety of the public and others.

The maximum length of excavation which may be left open in any length is 500 m or as directed by Engineer. The opening of two lengths within 500 m of each other shall require the approval of the Engineer.

The excavation shall be kept free of water to allow: placing of bedding, laying of pipes. inspection and testing of joints, coating of joints, placing of backfill and other activities within the pipe trench, to be carried out in a satisfactory manner.

The excavation shall be done such that it does not get far ahead of laying operations. Before excavating trench the alignment of pipeline shall be approved by Engineer. Cuttings length and other appurtenances shall be provided to suit detailed pipe configurations required.

To protect persons from injury and to avoid damage to property, adequate barricades, construction signs. red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for the traffic to use the roadways. The relevant Indian standards and the rules and regulations of local authorities in regards to safety provisions shall be observed.

The road metal and also the rubble packing shall first be stripped off for the whole width of the trench/pit and separately deposited in such place or places as may be determined by Contractor and approved by Engineer.

During excavation, large stones and rubble shall be separated and removed from the excavated soil and stacked separately. The material from excavation shall be deposited on either side of the trench leaving adequate clear distance from the edges of the trench and pit, or as may be necessary to prevent the sides of the trench pit to slip or fall, or at such a distance and in such a manner as to avoid covering fire hydrants. sluice valves, manholes cover etc. and so as to avoid abutting the wall or structure or causing inconvenience to the public and other service organisations or otherwise as Engineer may direct.

Contractor shall take into account additional excavation if any as Engineer may require in order to locate the position of water pipes, drains, sewers etc. or any other works which may be met with, in or about the excavation of trenches while quoting the rates for excavation of trenches while quoting e rates for excavation. Such service lines if met with during excavation shall be properly maintained by Contractor, by means of shoring, strutting, planking over, padding or otherwise as Engineer ma direct, and shall be protected by the Contractor from damage during the progress of the work. Any damage to the service lines shall be borne by Contractor. All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipe line of water, gas, sewage etc.

5.11 Deleted

5.12 Laying of pipes and fittings.

Pipes and fittings shall be laid in accordance with IS 12288 and manufacturers instructions.

The pipeline shall be constructed in lengths with a separate full-time gang working on each length. The work on lengths may proceed concurrently. The programme for pipe laying shall be submitted to and be approved by the Engineer at the start of the Contract. Any subsequent changes to the programme shall be submitted to and approved by the Engineer before work to a different programme is started. Excavation for the pipeline in anyone length shall not at any time proceed more than 2 km beyond the end of a hydraulically tested, completed and backfilled length of pipe, unless otherwise approved by the Engineer. The exposed joints between tested sections shall be disregarded in the above definition.

No metal tools or heavy objects shall be permitted to come into contact with the pipes or fittings. External coated pipe shall be handled at all times with wide non-abrasive canvas, rubber or leather straps or other equipment to prevent damage to the coating. The use of chains, wire slings, or any other handling equipment found to be injurious to the coating shall not be permitted. The timber or skids used to support the coated pipe prior to lowering into the trench shall be properly padded with sufficient bags stuffed with sand or straw for the purpose of protecting the coating. Alternatively, the pipe may be supported alongside the trench on mounds of sand. Any injury to the

protective coating from any cause must be repaired before the pipes or fittings placed in the trench. During laying operations, no debris, tools cloth or other material shall be placed in the pipe. Pipes and fittings shall be lowered into the trench with equipment suitable for the weight of the pipes and fittings, and they shall be carefully cleaned before jointing.

Pipes shall be laid accurately to the lines and levels shown on the Drawings, within a tolerance of ± 10mm.

Pipe alignments shall be straight between bends or curves. Length laid to curves shall only be allowed where shown on Drawings or in accordance with detailed proposals approved by the Engineer.

Properly painted sight rails shall be supplied and erected, with boning rods of predetermined measurement for the boning of individual pipes to the correct gradient. The sight rails shall be situated vertically above the line of the pipe or immediately adjacent thereto, and there shall at no time be less than three sight rails in position on each length of pipeline under construction to anyone gradient.

The Contractor may submit to the Engineer for his approval an alternative method of the control of pipe laying to the correct levels and alignment.

The joining of pipes shall be made in accordance with the requirements of this Specification. The Contractor shall obtain from manufacturers all special information regarding the handling of the pipes, joints and other fittings and he will be deemed to have made himself thoroughly conversant with all phases of pipe laying before commencing' the' works.

A "badger" or "bung" about 10mm smaller than the internal diameter of the pipe shall be kept in the pipe at all times, pulled forward as the work progresses. When pipe laying is not in progress, including overnight, the open ends of the pipeline shall be blanked off with a temporary watertight fitting approved by the Engineer. The pipe shall be suitably held down so that the pipe does not become buoyant in the event of the trench becoming flooded.

To restrict the flow of rain runoff along the trench the Contractor shall plug the trench with backfill material at distances not exceeding 250 m until the pipeline can be filled in. The plugs shall be removed when trench filling is taking place. In granular bedding areas the plugs shall be of clay and shall be left in.

All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipeline of water, gas , sewage etc. After excavation of trenches, pipes shall not be lowered unless the dimensions of trenches and bedding work for pipes at the bottom of the trenches are approved and measured by Engineer. Pipes and fittings/specials shall be carefully lowered in the trenches. Special arrangements such as cranes, tripods with chain pulley block for

lowering the pipes and fittings shall be made by Contractor. In no case pipes and fittings shall be dropped. Slings of canvas or equally non-abrasive material of suitable width or special attachment to fit the ends of pipes and fittings/specials shall be used to lift and lower the coated pipes and fittings/specials. The pipes and fittings/specials shall be inspected for defects and be rung with a light hammer preferably while suspended to detect cracks. If doubt persists, further confirmation shall be done by pouring a little kerosene/dye on the inside of the pipe at the suspected spot. No sign of kerosene/dye should appear on the outside surface. Pipes and fittings damaged during lowering or aligning shall be rejected by Engineer and shall be replaced by new one.

All the pipes are to be laid perfectly true both in alignment and to gradient specified. In case of spigot and socket pipe the socket end of the pipe shall face upstream, except when the pipeline runs uphill in which case the socket ends should face the upgrade. The laying of pipes shall always proceed upgrade of a slope. After placing a pipe in the trench, the spigot end shall be centered in the socket and the pipe forced home and aligned to required gradient. The pipes shall be secured in place with approved backfill material tamped under it except at the socket. Pipes and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipes and fittings/specials of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the jointing space. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by Engineer. During the period that the plug is on, the Contractor shall take proper precautions against floating of the pipe owing to entry of water into the trench. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long radius curves are permitted the deflection allowed at joints shall not exceed 2° for 600 mm and 800 mm, 3° for 300 mm, 350 and 450 mm diameter pipes.

The cutting of pipe for inserting valves, fittings or specials shall be done in a neat and workman like manner by using tools and taking precautions as per manufacturers' recommendations without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. For this purpose, pipe: cutting machine shall be used.

The valve chamber frame and cover (Cast Iron and Fibre reinforced concrete) shall be as specified in Part 24. clause 24.3.11.

5.13 Thrust / Anchor Blocks.

Anchor blocks shall be provided at horizontal bends. vertical bends or/and at intervals on pipelines with gradients in excess of 1 in 6 as noted on the Drawings, and at other locations ordered by the Engineer. The anchorages shall be made from concrete and constructed to the dimensions shown on the Drawings. Where faces of anchor blocks are shown to bear against undisturbed ground, the Contractor shall take all necessary measures to ensure that such bearing is given over the full dimensions shown.

5.14 Backfilling

Trenches shall be backfilled with approved selected excavated material only after the successful testing of the pipeline as directed by Engineer. Backfilling shall be in accordance with requirements specified hereafter and as shown on Drawings.

On completion of the pipe laying operations in any section, for a length of about 100 m and while further work is still in progress, refilling of trenches shall be started by the Contractor with a view of restricting the length of open trenches. Pipe laying shall closely follow the progress of trench excavation and the Contractor shall not permit unreasonably excessive lengths of trench excavation to remain open while awaiting testing of the pipeline. If the Engineer considers that the Contractor is not complying with any of the foregoing requirements, he may prohibit further trench excavation until he IS satisfied with the progress of laying and testing of pipes and refilling of trenches. Filling to a level of 300 mm above the crown of the pipe shall be done in accordance with the requirements of the clause on bedding. Care shall be taken during backfilling, not to injure or disturb the pipes,' joints or coating. Filling shall be carried out simultaneously on both sides of the pipes so that unequal pressure does not occur. Walking or working on the completed pipeline shall not be permitted unless the trench has been filled with the instructed bedding and surround material up to height of at least 300 mm over the top of the pipe except as may be necessary for tamping etc., during backfilling work.

The remaining portion of the trench shall be filled in with selected excavated material free from and topsoil, vegetation or boulders and clods of earth larger than 75 mm in size. Filling shall be done in layers not exceeding 150 mm in thickness accompanied by adequate watering, ramming etc., so as to be compacted to 95% of the maximum dry density as per Part 7 of 18:2720. The water contents of the soil shall be kept as near the optimum moisture content as possible. The trench shall be refilled so as to build up to the original ground level, keeping due allowance for subsequent settlement likely to take place. The surface of the refilled excavations shall be left slightly higher than the adjacent ground and be maintained by the Contractor to a smooth even slope.

The Engineer shall, at all times. have powers to decide which portion of the excavated materials shall be used for filling and in which portion of the site and in what manner it shall be so used.

If suitable material for refilling is not available from already excavated material the Contractor shall import material of approved quality as directed by the Engineer. Unless expressly specified in the Bill of Quantities. the Contractor shall include the above under backfilling rates.

Regular measurement of the field dry density shall be taken by the Contractor at various levels in the backfilling as required by the Engineer.

No mechanical plant other than approved compacting equipment shall run over or operate within the trench until backfilling has reached its final level or the approval from the Engineer has been obtained.

Should any subsidence take place either in the filling of the trenches or near about it during the works the Contractor shall make good the same at his own cost.

Surplus excavated material shall be used to fill in any low spots above the pipeline which are identified on the Drawings or are instructed by the Engineer. Such material shall be evenly placed and compacted in layers not exceeding 200 mm thick after compaction. The method of compaction employed shall achieve not less than 90% maximum dry density as determined from IS 2720: Part 7. Unless approved of by the Engineer, the width of areas to be filled shall not exceed 20m.

5.15 Pipelines under existing roads.

The Contractor shall programme the Works to reduce disruption to road traffic to a minimum, and before any work commences in existing roads shall:

(a) Obtain the full permission and approval of all authorities concerned serving notices of intent to start work as may be necessary and observing all the local Laws and Regulations

(i) Submit details of his proposals, and obtain approval from the Engineer and local highway authority

(ii) Constructing of temporary diversion roads

The pipelines crossing roads shall be encased in M15 concrete as shown on the drawings.

Pipelines which are laid along a road shall be laid in trench. The bed and surround shall be previously specified but above this the trench shall be backfilled with crushed rock up to the underside of the road sub-base. Not more than 20 % of the crushed rock shall pass through a IS test sieve with 4.75 mm apertures and all material shall pass through a IS test sieve having an aperture of 40 mm. The backfill shall be compacted in layers having a maximum thickness of 200 mm and the method of compaction used shall achieve not less than 95 % maximum dry density as determined from IS 2720: Part 7.

5.16 Cleaning of Pipes and fittings.

Pipelines shall be cleaned of all dirt, debris. dust or other deposits before hydraulic test to the satisfaction of Engineer. Cleaning with metal cleaning solution, acid, wire brushes, scrappers or sand paper shall not be permitted.

The section of the pipeline once cleaned shall not be entered into for any purpose later. Sufficient precaution shall be taken to prevent the ingress of any dirt,

debris, or dust inside the section. Failing this the section shall be cleaned again at the discretion of the Engineer. When deemed necessary by the Engineer suitable closures shall be provided at the open end or the ends of the cleaned sections

In the case of above ground pipeline, the length of the section to be taken up for cleaning shall be decided in consultation with the Engineer from the point of view of ventilation etc.

In case of buried pipeline a section shall be taken up for cleaning after the work of back filling around and over the pipeline is completed and the spiders have been removed from inside with approval of Engineer.

Pipelines shall be cleaned through a foam swab. Swabbing shall be carried out successively between adjacent swabbing points. The foam swab shall comply with the following:

Quality of swab shall be hard - when restrictions in the main do not reduce the diameter of the pipeline to less than two thirds of the swab diameter

Quality of swab shall be soft - when restrictions in the main are in excess of the above but do not reduce the diameter of the pipeline to less than one half of the swab diameter.

The Contractor shall make necessary arrangements for equipment, fittings and water necessary for cleaning the pipeline. The Contractor shall submit proposals for swabbing, water storage and disposal arrangements to the Engineer for approval.

No separate payment will be made for the work of cleaning and providing closures. The rates quoted for the laying of pipes shall include the cost of cleaning also.

5.17 Hydraulic Testing

Pipelines and fittings shall be subjected to hydraulic pressure tests in the presence of the Engineer which shall comply with IS 12288 unless otherwise specified.

Testing shall be carried out in two stages;

(i) Test of sections as construction proceeds

(ii) A test of the whole of the pipeline on completion

The Contractor shall equip himself with all plant, equipment, fittings and water necessary for the hydraulic tests. The Contractor shall submit to the Engineer, well in advance of the time of tests, details of his proposals, including the supply of water either by tankers or boreholes. No connections from the existing pipelines will be allowed, nor will any connections to the pipeline and pipe work which would involve cutting, tapping or altering the Permanent Works be allowed.

Test gauges shall be of approved manufacture having dials at least 200 mm diameter. graduated such that the test pressure is at least 75 % of the full-scale reading shall be used, If necessary different gauges shall be supplied for different pipeline sections. Two gauges shall be provided for the sole use of the Engineer and shall remain in Engineer's possession for the duration of the Contract. All gauges shall be dead weight tested and calibrated at the commencement of work and at regular intervals as required by the Engineer.

The Contractor's arrangements for testing shall include a suitable means of quick installation and removal of the Engineer's gauges during testing.

5.18 Hydraulic Testing Pipelines

The Sectional Hydraulic Test shall be carried out after the pipeline section to be tested has been laid, Jointed and backfilled to a depth sufficient to prevent floatation, but leaving the joints exposed which have not been tested, the sections to be tested shall be to the approval of the Engineer and shall not be longer than 2000 m or 500 m when either the pipeline is laid adjacent to or underneath the carriageway or when section includes an air valve chamber. The joints between each tested section shall be left exposed until the pipeline has passed the Test on Completion,

In addition to the above requirements the Contractor shall perform a hydraulic test on the first 200 m length of pipeline to be laid under the contract. This test shall be undertaken within one month of the Contractor commencing the laying of pipes. Should the pipeline fail the test or the Contractor fails to undertake the test, all laying work shall come to a halt until that section of pipeline passes a hydraulic test.

Each length of the pipeline to be tested shall be capped or blanked off at each end and securely strutted or restrained to withstand the forces which will be exerted when the test pressure is applied. Testing against closed valves will not be permitted. Washout valves shall be fitted with blank flanges and these together with in-line valves shall be left open. Air valves already fitted shall be permitted to function during the test.

Proposals for testing where thrusts on structures are involved, even where thrust flanges on the piping are installed, shall be submitted, with the calculations of the forces to be carried, to the Engineer for approval.

The method of filling the pipeline with water shall be approved by the Engineer. The length under test shall be filled making certain that all air is displaced through an air valve installed at the top of the blank flange situated at the high end of the line. The length shall then remain under constant moderate pressure, 10 to 20m head of water, for a period of several hours until the pressure can be maintained without additional pumping.

The pressure shall then be slowly increased at a maximum rate of I bar per minute to the full test pressure and pumping discontinued for 3 hours or until the

pressure has dropped by 10m, whichever occurs earlier. Thereafter pumping shall be resumed and continued until the test pressure has been restored. The quantity of water pumped to restore the pressure shall be the measure of leakage from discontinuation of pumping until its resumption.

The pipe length shall pass the test if the leakage is not more than 1.079 litres per mm diameter per kilometre per 24 hours for each 100m head of pressure applied and the full test pressure has been sustained for at least eight hours.

Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint the Contractor shall, at his own cost, replace the pipe, repair the pipe or re-make the joint and repeat the hydraulic test.

No pipeline shall be accepted until the leakage on any length is not more than the rate of leakage specified above and all sources of leakage have been rectified.

The Test on Completion shall be carried out after all the pipeline sections have been satisfactorily tested and the Joints between each section completed to provide a continuous test length between contract interfaces.

Pipelines shall be tested as above except where the Engineer issues such instructions as are necessary for testing parts of the Works that have been designed for stresses limited by considerations other than those applying to the pipeline systems.

5.18.1 Test pressures

Test pressures are to be measured in bars at the centre of the blank flange situated at the lowest end of the pipeline under test. Unless otherwise specified or shown on the drawings pipeline test pressure shall be in accordance with the following:

DI /MS pipe and fittings without HSC	10 bar
DI /MS Pipes and fitting with HSC	05 bar

For testing of sections of pipeline containing air valve chambers the Contractor shall verify from manufacturer that the air valves are capable of operating under and sustaining the test pressure.

5.19 Chamber Markings

Details like valve type. size, cistern number shall be painted on all valve chambers as directed by Engineer. Where valve chambers are flush with the ground, suitable marker posts shall be provided adjacent to the chambers at a suitable location with all details approved by Engineer.

In case of the pipeline laid above ground details such as chainage, invert levels of pipe, saddle number, culvert number, anchor/thrust block number etc., shall be suitably painted either on the pipeline or the supporting structure in distinct colour.

5.20 Measurement and Payment

The measurement for pipes for items specified in Bill of Quantities shall be on running metres of net length along the centre line of the pipe excluding the length of specials and appurtenances. Payment for pipes shall be made in running metres after production of test certificates specified and directed by Engineer.

Payment for laying the pipes and specials shall be made after successful testing at site.

5.21 Location and Protection of Existing Public and Private Utilities.

Once permission to work has been obtained from the road authorities, and prior to excavation, the Contractor shall contact all utility companies and householders in roads where work is to take place and inform them of the nature of the work and its likely duration. Information should be obtained from utilities companies about the location of their utilities, preferably in the form of record drawings, and the Contractor should carry out utilities tracing using electronic equipment to verify the positions of utilities. Trial excavations should also be carried by hand to further confirm locations of utilities. The Engineer will only permit trench excavation to proceed when he is satisfied that adequate efforts have been made to establish the alignments and depths of existing utilities.

All underground utilities such as water pipes, gas pipes, drains, sewers, electricity and telephone cables exposed in excavations, shall be properly supported and protected by the Contractor to the satisfaction of the Engineer so as to avoid damage to the utility or to the Works as a result of collapse of the utility. Similarly, poles carrying overhead electricity and telephone wires should be braced and supported where there is any likelihood of collapse as a result of excavation.

5.22 Valves-Deleted- Given in subsequent sections.

VI. ANCILLARY STRUCTURES

6.1 The Contractor shall build Valve Chambers & Thrust Blocks/Anchor blocks and such other miscellaneous structures that may be required at the locations shown by the Engineer and as shown in the drawings or as may be otherwise specified or directed. unless otherwise specified in this Chapter or advised by the Engineer based on the site conditions.

The various structures shall be built as the pipe laying progresses and the Engineer at his discretion, may stop work entirely on the laying of pipe or construction of other structures, until the construction of the structures already approved by the Engineer are completed by the Contractor.

6.2 Thrust Blocks

Thrust blocks shall be provided for both horizontal and vertical bends as suggested, for effective transfer the hydrostatic thrust developed during the operation of the rising main. They shall be constructed at the locations shown in

the alignment drawings, and are of the respective dimensions shown therein. The surrounding virgin land of the thrust blocks shall not be disturbed, to effectively transfer the thrust developed in the main.

6.3 Valve Chambers

RCC valve chambers shall be provided for all valves. These valve chambers are of different sizes suitable for air valves, scour valves & Control valves with RCC pre-cast slabs covering.

6.4 Structures for Crossing Canal/ Nallahs and Other Miscellaneous Structures

Structures for crossing the pipeline over canals/Nallahs and other miscellaneous structures not listed in these specifications but may be required to be built shall be as per construction drawings and as described in Bill of quantities. The materials of construction of workmanship for those structures shall conform to the relevant Standard Specifications. The measurement of quantities involved in these structures for payment shall be done as per dimensions of the respective drawings.

6.5 Grade of concrete

6.5.1 Ordinary Concrete

In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume. The ordinary concrete shall be in four grades designated as M 7.5, M 10, M 15 and M 20. It can also be specified by volumetric mix as given in Table-4 below. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic meters in volume. Shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume and in case it is damp, allowance for 'bulkage' shall be made as per IS: 2386 (Part III).

Ingredients required for ordinary concrete containing one bag of cement for different proportions of mix shall be as given in Table-4 below.

Table-4

Ingredients Required for Ordinary Concrete

Grade of Concrete*	Nominal Mix by volume Cement: Fine Aggregate: Coarse Aggregate**	Total quantity of dry in kg (max) by mass per 50 kg of cement (to be taken as the individual masses of fine and coarse aggregates)	Quantity of water in liters (max) per 50 kg of cement***
M 7.5	1:4:8	625	45
M 10	1:3:6	480	34
M 15	1:2:4	350	32
M 20	1:1.5:3	250	30

* In the designation of a concrete mix, letter 'M' refers to the mix and the number refers to the specified 28 days' works compressive strength of that mix on 150 mm cubes, expressed in N/ sq. mm.

** The proportions of the aggregate shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger.

*** The amount of water should be kept minimum required for proper workability. The quantity given in the column is not to be exceeded.

6.6 Strength Requirement of Concrete

Where Ordinary Portland Cement conforming to IS.269 or Portland Blast Furnace Cement conforming to IS:455 is used, the compressive strength requirements for various grades of concrete controlled as well as ordinary shall be as given in Table-5. Where rapid hardening Portland cement is used, the 28 days compressive strength requirements specified in Table-5 shall be met at 7 days.

For controlled concrete, the mix shall be so designed as to attain in preliminary tests a strength at least 33 per cent higher than that required on work tests for concrete up to and including M 25, and 25 per cent higher for higher grades. Preliminary tests need not be made in case of 'ordinary concrete'.

Table-5 :Strength Requirements

Grade of Concrete	**Compressive test Strength on 150 mm cubes after testing in accordance with IS: 516 (N/sq.mm)**	
	Minimum at 7 days	**Minimum at 28 days**
M 10	7	10
M 15	10	15
M 20	13.5	20
M 25	17	25

In all cases, the 28 days compressive strength specified in Table-5 shall alone be the criterion for acceptance or rejection of the concrete.

Where the strength of a concrete mix, as indicated by tests, lies in between the strength for any two grades specified in Table-5, such concrete shall be classified for all purposes as a concrete belonging to the lower of the two grades between which its strength lies.

6.7 Use of Plums in Ordinary Concrete

Stone Plums shall not be used unless specified in the drawings. When stone plums are used, the size may be from 150 to 300 mm. The maximum dimension of these stones or plums shall not exceed 1/3rd the least dimension of the members.

All plums shall be hard, durable, clean and free from soft materials or loose pieces or deleterious substances in them and shall not have sharp corners.

During concreting the first layer of concrete of the specified mix shall be laid to a thickness of at least two and a half times the thickness of the maximum size of plums to be used. The plums shall then be laid while the top portion of this concrete is still green but sufficiently stiff to prevent complete submergence of the plums under their own weight. These plums shall be about half embedded in the concrete and the remaining part exposed so as to form a key with the next layer of concrete. No plums shall be used for concrete-laid under water.

While placing the plums, care shall be taken to see that the clear distance between any two plums is not less than either the width or thickness of either of the plums. The distance from plums to the outer surface or from any steel reinforcement shall be equal to greatest width of the plum.

If plums of stratified stone are used, they shall be laid on their natural bed. Stones with concave faces shall be laid with the concave portion upwards. The thickness of the next and successive layers of concrete shall be at least twice that of the largest plums. The total volume of plums shall not exceed 15% of the volume of the finished concrete.

5.1 Materials

Steel plates – The steel plates for pipes fittings, specials and stiffeners shall be of mild steel conforming to IS2062 Grade B, with no negative tolerances on the plate thickness

Cement – Ordinary Portland cement conforming to IS 269.

Aggregate – The aggregate shall confirm to IS 383

Water – The water used in preparation of concrete mix shall conform to the requirements of mixing water specified in IS : 456

Welding consumables – such as electrodes, filler rods and wires shall conform to IS 814, IS 3613, IS 6419 and IS 7280

When requested by the Engineers, the contractor shall provide test sample of the materials to be used in the works for testing. The cost of such tests shall be borne by the contractor and shall be included in his item rates.

5.4 Inspection

All works and material under specification will be rigidly inspected during all phases of manufacture and testing and such inspection shall not relieve the contractor of his responsibility to furnish materials and performed work in accordance with this specification.

The contractor will notify the engineer, in advance of the procurement of materials and fabrication thereof, in order that the employer may arrange for mill and shop inspection. The engineer may reject any or all materials or work that does not meet with any of the requirements of this specification. The contractor shall rectify or replace such rejected material/performed work at his own cost, to the satisfaction of the engineer.

The Engineer shall have free access to those parts of all plants or any other premises and sites that are concerned with the furnishing of materials or the performance of the work under this specification.

The contractor shall supply free of cost required specimen of materials for testing by the employer at any time during the progress of work and shall bear the cost of all such tests or retests to the satisfaction of engineer.

The contractor shall provide 2(two) sets of accurate "GO" and 'No Go' ring gauges to measure the diameter of pipes, specials and fitting for the use of the Engineer at no extra cost.

5.9 Pipeline Construction

5.9.1 General

Laying/Erection of fabricated pipe lengths shall be carried out by the Contractor who shall equip himself, at his cost with all necessary tools, machinery, labour etc., required for the purpose. The pipeline shall be constructed in lengths with a separate full time gang working on each length.

Except for routine welding of joints, no other work shall be done in the absence of Engineer.

The components of the sections of the pipeline such as plates, and pedestals have been so designed that the centers of the plates and pedestals shall coincide at the mean temperature of the locality. For this reason, all works such as fixing flanges, plates etc. in true alignment, and in correct position and tack welding pipes shall be done at the mean temperature. For ascertaining the temperature, the contractor shall provide mercury cups and fix them to the pipe shell from outside and shall also provide thermometers of the required type and range. No extra payment shall be made for this.

5.9.2 Laying Program

The contractor shall submit a detailed bar chart for manufacturing and laying of the pipeline, which shall be subject to the Engineer's approval. In preparing this bar chart, the contractor shall plan his activities such that the laying of pipes shall closely follow the manufacturing schedule and no pipes shall remain in factory or at site for a period more than two months.

Together with the chart he shall submit a methodology describing how he will carry out this work within the contractual period and the required resources in terms of construction equipment and other facilities that he shall utilize to complete the works.

5.9.3 Contractor to Resurvey the Pipeline Route

While setting up the site the contractor shall undertake survey of the pipeline route and compare this with the survey supplied at the time of tender and a joint record. Levels are to be taken at 30 m intervals and at any sharp changes in level. Where practical the chainage points shall coincide with those original surveys. Not less than 14 days before commencement of pipe laying the Contractor shall supply the Engineer, any discrepancies, if observed, with two hard copies and one computer disk copy of the survey.

The format of the survey shall be identical to the longitudinal sections which formed part of the tender documents. The Engineer shall supply the contractor a copy of the longitudinal section and the contractor is to use this to produce new drawing. Details of all the benchmarks which were used in the original survey of that length of pipeline shall be supplied to the contractor by the Engineer.

The Engineer shall resolve any problem arising from discrepancies between the two surveys and supply the contractor with any revised Drawings that may be required.

5.10 External Coating with Corrosion resistant tapes

Unless otherwise specified or stated on the drawings the pipeline to be laid underground and the exposed pipeline supported on saddles shall be coated with the corrosion resistant tapes confirming to IS: 10221-1982 Appendix B.

5.10.1 Material

(i) Primer: Primer shall be a coal tar / asphalt or suitable resin product. It shall be a liquid that can be applied without heating and shall produce an effective bond between the surface to be protected and the subsequent coating of coal tar / asphalt tape. Primer shall contain no benzol and shall not settle in the container to form a cake that cannot be mixed easily by hand stirring. Primer shall have good sparing and / or brushing properties and an minimum tendency to produce bubble during application.

(ii) Tapes: Tapes shall be comprised of coal tar / asphalt component supported on fabric of organic or inorganic fibers. The coal tar / asphalt component shall comply with quality provisions as in 4.1.2 & table 13 of IS: 10221-1982. The fabric shall be thoroughly coated and completely covered on both sides with coal tar / asphalt component. Tape shall be furnished in standard width as recommended by the manufacturer. Rolls shall be warmed on hallow course having a minimum inside diameter of 37mm. Tape shall have sufficient pliability at a temperature of 25^{o} to unwind from the roll without disbanding the coal tar / asphalt component from the fabric.

- Length: the standard length of tape on one roll shall be 9, 15 or 23m
- Thickness: the variation in the thickness of the tape shall not exceed ± 0.125mm from the thickness specified. In no case shall thickness of the tape be less than 4.00mm.
- General requirement: when heated to a condition permitting conformation to the surface to be coated, the tape shall withstand, without tearing, the tensile force necessary to obtain a tightly wrapped coating free of voids. The tape shall provide a minimum thickness of 15 mils of coating between the steel surface and the inner face of the fabric when applied under tension necessary to provide a void free warp. Should the tape have plastic film separator of the type that is not removed prior to application,

the thickness of the separator shall not adversely affect the bond between overlapped sections of tape.

5.10.2 Application of Wrapping tapes:

(i) Cleaning: Pipe surfaces shall be thoroughly cleaned and dried before the primer is applied, and shall be free of dirt, grease, oil rust, scale or other foreign matter. The pipe shall be cleaned by any one of the following mutually agreed methods.

- Grit / shot blasting
- Sand blasting &
- Mechanical cleaning.

Primer shall be applied by brush, glove or spray so as to give a coating thickness i.e., between two & four mills when wet. The primer shall be allowed to dry to the touch prior to tape application. Primer & tape shall be furnished by the same manufacturer.

If the application is done in cold whether, the surface of the pipe shall be pre-heated until it is warm to the touch and until traces of moisture are removed, and than the primer shall be applied allowed to dry.

6.10.3 Field Application of Tape:

The tape shall be wrapped in accordance with the manufacturer's recommendations in a manner that shall meet the adhesion and holiday detection requirements of IS: 10221-1982. In any event, there shall be a minimum of 12mm overlap per single wrap. Earlier single or double wraps shall be specified by the purchaser. In application, care shall be taken that there are no air pockets or bubbles beneath the tape and shall be in intimate contact with the primed steel surface. The manufacturer shall provide assistance in demonstrating the proper method of application if requested by the contractor.

6.10.4 Field Adhesion Test:

Adhesion tests shall be made to determine the proper bond between the coal tar/ asphalt component of the tape and the properly primed pipe. The number of adhesive tests required to determine quality of application is at the inspector's option, but, desirably, no more than one test per special section, connection, or fittings should be performed to avoid extensive repair unless defects are found in the first test.

The temperature of the tape and pipe to be tested shall be between 10^{o}C and 27^{o}. If the temperature is outside this range, hot or cold water shall be poured over the test area until this temperature range is attained. A test area shall be selected by the inspector where the tape is smooth for 15cms in the longitudinal direction

of the tape. Two knife cuts that are 15cm long and 5cms apart shall be made through the tape. A flat blade shall be used to pry up 5cm of the fabric. This 5cm flap of fabric shall be grasped firmly in one hand and shall be pulled a quick motion in the direction of the remaining 10 cm of the 15cm knife cut.

The adhesive is satisfactory if the tape tears at the point of stripping or the or the fabric strips from the under laying coal tar component, leaving exposed not more than 10 percent of the primer or metal.

6.11 Buried Pipelines

6.11.1 Trenching

Trenching includes all excavation which is carried out either by hand or by machine and shall be carried out in accordance with all general requirements of Part-5. In addition to those general requirements, the following requirements shall apply to pipelines:

The width of the trench shall be kept to a minimum consistent with the working space required and having regard to the safety of the trench, the method of laying and jointing the pipe and the need to avoid damage to pipe coating and so as to provide the minimum horizontal clearance as stated in the table below. The bottom of the trench shall be properly trimmed to permit even bedding of the pipeline.

The portion of the trench which extends from the formation level to not less than 300 mm above the crown of the when laid in its correct position, shall unless otherwise specified or ordered by the Engineer, be formed with vertical sides. The clearance between the sides and the bottom of the trench and the barrel of the pipe shall not exceed the following, inclusive of any allowances required for temporary trench supports:

Pipe Nominal Bore (mm)	Bottom Clearance (mm)	Site Clearance (mm)
600 to 1000	250	400
1050 to 2500	300	500

The clearance at joints may be increased to allow the joints to be made and inspected, any proposed increased shall be approved by the Engineer.

All trenches deeper than 1.2m shall have the trench walls battered or supported to ensure the safety of all persons working in the trench of required. The contractor is to provide details of these arrangements for approval by the Engineer prior to any work being undertaken in such a trench.

No excavations with battered sites shall be made in roads, footpaths, private gardens, or within 10m of any buildings or other structures.

The contractor shall erect temporary fencing around all open excavations and post warning science in English and the local languages. All fencing shall be at

least 1 m tall, rigid in nature and strong enough to prevent people falling into the trench. The contractor shall also take all other necessary measures to ensure the safety of the public and others.

The maximum length of excavation which may be left open in any length is 500 m. the opening of two lengths within 500 m of each other shall require the approval of the Engineer.

The excavation shall be kept free of water to allow: placing of bedding, laying of pipes, welding of pipes, inspection and testing of joints, coating of joints, placing of backfill and other activities within the pipe trench, to be carried out in a satisfactory manner.

5.11.2 Bedding

The depth and type of bedding shall be as shown in the Drawings or as directed by the Engineer. Where rock or boulders are encountered, the trench shall be transmitted to a depth of at least 300 mm below the level at which the bottom of the barrel of the pipe is to be laid and filled to a like depth with sand as shown on the Drawings or as directed by the Engineer.

The class of bed and surround to be used are indicated below:

Class of bed and surround	Brief description of bedding material
Class N	Well Graded Sand
Class S	Granular material

Class S bed and surround shall be used on all pipes unless otherwise specified or shown on the Drawings.

Class N bed material shall only be used where the pipe trench is founded in hard rock or otherwise directed by the Engineer. the sand shall be clean and well graded and free from topsoil, clay or vegetable matter and to the approval of the Engineer. if the sand supplied is unclean it shall be washed. In no case shall sand containing more than 3.5% by dry volume or 5% by wet volume of clay, loam or silt be accepted. Tests specified for determining silt in sand and organic impurities as described in IS 383 shall apply.

The graded granular bed material for use in Class S bedding and surround shall consist of durable gravel, crushed stone or disintegrated rock. Selected material excavated from the pipe trench may be used, provided it contains no topsoil, clay or vegetable matter and is to the approval of the Engineer and shall be supplied with the certification which gives details of its content of the granular material shall not exceed 0.5% and 0.06% by weight respectively.

Graded Material.

The Contractor's method of grading the excavated material shall be to the approval of the Engineer. All Class S graded material shall pass through test sieves to IS 460 (Part 1) in the following proportions by mass :

Aperture Size	Percentage passing
50 mm	100%
37.5 mm	90 - 100%
20.0 mm	35 – 70%
14.0 mm	25 – 55%
10.0 mm	10 – 40%
5.0 mm	0 - 5%

5.11.3 Construction of Class S bed and Surrounds

Class S pipe bed and surround shall be constructed as indicated on the Drawings.

The granular material shall be evenly spread over the full width of the formation and lightly compacted to a level slightly higher than level corresponding to the underside of the pipe barrel to allow for settlement of the pipe to the correct level.

Following placement and jointing of the pipe further granular material shall be placed in the trench, special care being taken to fill under the sides of the pipes to ensure full contact with the barrel of the pipe.

Field joints which have not been tested shall be left exposed for a minimum length of 150 mm each side of the joint. The granular material shall then be placed and compacted evenly on both sides of the pipe to a depth of 300 mm above crown of the pipe.

Trench supports shall be withdrawn gradually in accordance with the progress of the fill with the provisions that such withdrawal shall not prejudice the safety of the works.

The contractor shall ensure that the material to the sides of the pipe is adequately compacted in layers having a maximum thickness of 150 mm and that the method of compaction used shall achieve not less than 95 % of the maximum dry density as determined from IS 2720: Part 7

After each section of the pipeline has passed the hydraulic test, the exposed joints shall be backfilled and compacted to the above specification.

The same general requirements shall apply to Class N bedding.

5.11.4 Pipe Laying

Pipe shall be laid in accordance with IS 5822 unless otherwise specified herein.

The pipeline shall be constructed in lengths with a separate full time gang working on each length. The work on lengths may proceed concurrently. The programme for pipe laying shall be submitted to and be approved by the Engineer at the start of the contract. Any subsequent changes to the programme shall be submitted and approved by the Engineer before work to a different programme is started.. excavation for the pipeline in any one length shall not at any time proceed more than 2 km beyond the end of a hydraulically tested, completed and backfilled length of pipe, unless otherwise approved by the Engineer. The exposed joints between tested sections shall be disregarded in the above definition.

No metal tools or heavy objects shall be permitted to come into contact with the pipes or fittings. External coated pipe shall be handled at all times with wide non- abrasive canvas, rubber or leather straps or other equipment to prevent damage to the coating. The use of chains, wire slings, or any other handling equipment found to be injurious to the coating shall not be permitted. The timber or skids used to support the coated pipe prior to lowering into the trench shall not be properly padded with sufficient bags stuffed with sand or straw for protecting the coating. Alternatively, the pipe may be supported alongside the trench on mounds of sand. Any injury to the protective coating from any cause must be repaired before the pipes or fittings placed in the trench. During laying operations, no debris, tools cloth or other material shall be placed in the pipe. Pipes and fittings shall be lowered into the trench with equipment suitable for the weight of the pipes and fittings, and they shall be carefully cleaned before jointing.

Pipe shall be laid accurately to the lines and levels shown on the Drawings, within a tolerance of +- 10 mm.

Pipe alignments shall be straight between bends or curves. Length laid to curves shall only be allowed where shown on Drawings or in accordance with detailed proposals approved by the Engineers.

Properly painted sight rails shall be supplied and erected, with boning rods of predetermined measurement for the boning of individual pipes to the correct gradient. The sight rails shall be situated vertically above the line of the pipe or immediately adjacent thereto, and there shall at no time be less than three sight rails in the position on each length of the pipe under construction to any one gradient.

The contractor may submit to the Engineer for his approval an alternative method of the control of pipe laying to the correct levels and alignment.

The joining of pipes shall be made in accordance with the\e requirements of this specification. The Contractor shall obtain from manufactures all special information regarding the handling of the pipes, joints, and other fittings and he will be deemed to have made him thoroughly conversant with all phases of pipe laying before commencing the works.

A "badger" or "bung" about 10mm smaller than the internal diameter of the pipe shall be kept in the pipe at all times, pulled forward as the work progress. When pipe laying is not in progress, including overnight, the open ends of the pipeline shall be blanked off with a temporary watertight fitting approved by the Engineer. The pipe shall be suitably held down so that the pipe does not become buoyant in the event of the trench becoming flooded.

To restrict the flow of rain runoff along the trench the contractor shall be plug the trench with backfill material at distances not exceeding 250 m until the pipeline can be filled in. the plugs shall be removed when trench filling is taking place. In granular bedding areas the plugs shall be of clay and shall be left in.

5.11.5 Level Control

The criterion for the level to which transmission main shall be laid such that the cover above the crown of the pipe to ground level shall be as specified in the drawings but in no case shall be less than 1200 mm unless otherwise directed by the Engineer.

5.11.6 Laying to Curves

Where pipes are to be laid to curves, the deflection at each joint shall not exceed one degree. For sharper curves specifically made bends shall be provided.

5.11.7 Lowering and Jointing

The pipe shall be lowered into the trenches such that no part of any shoring is disturbed or damaged and if necessary, additional temporary struts may be fixed during the lowering operations. Care shall be taken to ensure that the longitudinal joints of two consecutive pipes at each circumferential joint are staggered by 90 degree. While assembling the pipes, the ends shall have to be brought close enough to leave a uniform gap not exceeding 4 mm. there shall be no lateral displacement between the pipe faces to be joined. If necessary, spiders from inside and tightening rings from outside or other suitable equipment shall be used to bring the two ends in perfect contact and alignment. In no case shall hammering or longitudinal slitting be permitted. Jacking may be permitted for this purpose in particular circumstances and approval by the Engineer.

When the pipe is properly assembled firmly supported on wooden beams and wedges or by other approved means it shall be checked for correct line and level

and tack welded. The tack welded circumferential joints shall then be welded fully.

On completion of the pipe jointing the external portion shall be coated with M15 concrete and the trench and the welding pits shall be cleaned. The welding pit shall be filled with approved bedding.

5.11.8 Floatation

The contractor shall take proper precautions against the risks of floatation and the flooding of the excavated works and shall make due allowances in his programme for any closure he considers necessary on account of monsoon.

Should any section of the pipeline be affected by floating in the course of works the entire work shall be removed and then reinstalled to the satisfaction of Engineer. The entire cost of laying it again to the correct line and level shall be to account of the Contractor.

5.11.9 Steel Props

In order to effectively provide cement mortar lining to the inside of the pipes and to avoid difficulties during the work, it is necessary that the roundness of the pipes is maintained circular till the lining work is taken up. To achieve the same, steel adjustable screw type props of screw or similar approved type consisting of minimum six legs(three props) shall be fixed inside the pipe and the diameter correctly set.

The design and drawings of the props that the contractor intends to use should be approved by the Engineer before starting the work. These props shall be fixed vertically at intervals as directed by the Engineer. The props should be kept in position at least for three days after the encasing of the pipe in that section is completed or until refilling is done to the full height of fill over the pipe in case the pipes are not encased. The props shall be removed only after obtaining permission from the Engineer.

5.12 Internal Cement Mortar Lining

All pipes and fittings shall be internally lined with cement mortar in accordance with IS:11906/AWWA C602. Cement mortar in lining shall be applied in-situ after pipe laying and after sectional hydraulic testing.

Cement shall be Portland cement in accordance with IS 8112

Sand used for lining shall be tested with standard sieves as per IS 460 and requirements specified in IS 11906

The minimum cement content shall be 100 kg/m3 and the water : cement ratio by mass shall be between 0.3 and 0.45:1

The mortar shall stop 100 mm back from the faces of any joints. The end face shall be vertical.

5.12.1 Surface Preparation

The interior surface of the pipe to be lined shall be cleaned to remove all rust, chemical or other deposits, oil, grease and all accumulations of water, dirt, and debris. The cleaning of the surface shall be carried out by the use of suitable chemical or mechanical means to the approval of the Engineer. The extent of cleaning shall be to the satisfaction of the Engineer.

All loose mill scale, dirt, rust, and accumulation of construction debris shall be removed from the interior of the steel pipeline. The pipeline shall be cleaned by use of a power-driven cleaner incorporating revolving brushes on rotating arms.

Immediately prior to the travel of the lining machine through the pipeline, all foreign material shall be removed. This includes small sand and loose mortar that might have accumulated since the work of preparation of surfaces was completed.

5.12.2 Mix Proportion

Proportion of sand to cement shall not be more than 1.5 parts sand to 1 part by volume. Mortar composing of cement, sand and water shall be well mixed and of proper consistency to obtain a dense, homogeneous lining that will adhere firmly to the pipe surface. The cement mortar mix shall comply with strength and density requirements specified in IS 11906/AWWA C602. No admixtures shall be permitted unless approved by the Engineer.

5.12.3 Thickness of Lining

The lining shall be placed by centrifugal method in one course by a machine traveling through the pipe and discharging the mortar at a high velocity over all pipe sections and long radius bends. The discharge shall be from the rear of the machine so that the freshly applied mortar will not be marked. The rate of travel of the machine and the rate of mortar discharge shall be mechanically regulated so as to produce uniform thickness throughout. The mortar must be densely packed and shall adhere to the pipe wherever applied.

5.12.4 Surface Finish

Mortar lining shall be mechanically trowel led except for the places where hand toweling is expressly permitted by the Engineer.

The lining shall be provided with attachments for mechanically trowel ling the mortar. Both the application and toweling of the mortar shall take place at the rear of the machine so that the freshly placed and trowel ling of the mortar will not be damaged. The trowel attachment shall be such that the pressure applied to the pipe will be uniform and produce a lining of uniform thickness with a

smooth and even finished surface free of spiral shoulders. The finished surface of machine placed and trowel led linings in pipe shall be examined according to the following procedure.

Thickness of lining shall be ascertained frequently during placing of mortar and trowel ling using an approved non-destructive method.

In the stretch of pipe that has been lined and trowel led in each day's run, ten places shall be selected in straight sections of the pipe by the Engineer. In each of the ten places the thickness of the lining shall be re measured by non-destructive means as directed by the Engineers.

Defects in lining including but not restricted to sand pockets, voids, over sanded areas, blisters, cracked and dummy areas, and thin spots shall be removed, and the area shall be repaired to the full required thickness of the mortar lining. Defective areas encompassing the full diameter to the pipe shall be replaced by machine. Defective lining rejected at the time of lining shall be removed before initial set of the mortar. Defective lining rejected after initial set shall be replaced or repaired by the most practical method as determined by the Engineer.

Hair cracks or cracks up to 0.25 mm width and not over 300 mm in length in finished linings may be considered acceptable at the discretion of the Engineer but larger cracks shall be repaired or removed and redone all as directed by the Engineer.

5.12.5 Hand application

Cement mortar lining of bends, specials, areas closely adjacent to valves and other such places where machine placing may not be practical shall be performed by hand. The Engineer may order the correction for any defect by hand application.

Cement mortar for hand work shall be of the same materials as the mortar for machine placed lining.

The areas to be lined shall be thoroughly cleaned as specified earlier and, if necessary, shall be moistened with water immediately prior to placing the hand-applied mortar.

Steel finishing trowels shall be used for the hand application of cement mortar, except at bends the outer edges of hand trowel led areas may be brushed in odder to reduce the abutting offset.

All hand finishing work in a section of the pipeline shall be completed within 24 hours after completion of the machine application of mortar lining that section. If necessary, application of mortar lining by machine shall be delayed or stopped to assure compliance with this schedule.

Hand placed mortar shall have a uniform and smooth surface with smooth transitions to adjacent machine placed linings.

5.12.6 Curing

Curing shall commence immediately after completion of the mortar lining and hand finishing of a section of pipeline. This shall, not be later than 8-hours after mixing of mortar. The lining shall be kept continuously in moist condition for a period of 14 days. During the operation of lining, finishing and curing, exterior surface of the pipe exposed to sunlight shall be sprinkled with enough water to keep the pipe cool. Open ends of pipes shall be suitably closed so as to maintain a moist atmosphere and prevent draught. Curing of mortar lining and simultaneous cooling of the pipeline externally shall be continued even beyond the period of 14 days if so directed by the Engineer.

5.12.7 Tests

Test blocks of the same material as used for the lining shall be made in 150 mm cube moulds and subjected to cube crushing tests. Each block shall be removed from its mould as soon as practicable and cured under the conditions of temperature and humidity identical with those in which the lining of the pipe is cured. The number of tests shall be at least 4 cubes for each age and water cement ratio for each days work. The work cube strength of the test cube shall not be less than 300 kg/cm^2 after 28 days of curing or 170 kg/cm^2 of 7 days of curing. The density of the test cube shall not be less than 2300 kg/m^3

5.12.8 Backfilling

On completion of the pipe laying operations in any section, for a length of about 100m and while further work is still in progress, refilling of trenches shall be started by the contractor with a view of restricting the length of open trenches. Pipe laying shall closely follow the progress of trench excavation and the contractor shall not permit unreasonably excessive lengths of trench excavation to remain open while awaiting testing of the pipeline. If the Engineer considers that the contractor is not complying with any of the foregoing requirements, he may prohibit further trench excavation until he is satisfied with the progress of laying and testing of pipes and refilling of trenches. Filling to a level of 300 mm above the crown of the pipe shall be done in accordance with the requirements of the clause on bedding. Care shall be taken during backfilling, not to injure or disturb the pipes, joints or coating. filling shall be carried out simultaneously on both sides of the pipe so that unequal pressure does not occur. walking or working on the completed pipeline shall not be permitted unless the trench has been filled with the instructed bedding and surround material, up to height of at least 300 mm over the top of the pipe except as may be necessary for trapping etc., during backfilling work.

The remaining portion of the trench shall be filled in which selected excavated material free from and topsoil, vegetation or boulders and colds of earth larger than 75 mm in size. Filling shall be done in layers not exceeding 150 mm in

thickness accompanied by adequate watering, ramming etc., so as to be compacted to 95 % of the maximum dry density as per Part 7 of IS: 2720. The water contents of the soil shall be kept near the optimum moisture content as possible. The trench shall be refilled so as to build up to the original ground level, keeping due allowances for subsequent settlement likely to take place. The surface of the refilled excavation shall be left slightly higher than the adjacent ground and be maintained by the contractor to a smooth even slope.

The Engineer shall, at all times, have powers to decide which portion of the excavated materials shall be used for filling and in which portion of the site and in what manner it shall be used.

If suitable material for refilling is not available from already excavated material the Contract shall import material of approved quality as directed by the Engineer.

Regular measurement of the field dry density shall be taken by the Contractor at various levels in the backfilling as required by the Engineer.

No mechanical plant other than approved compacting equipment shall run over or operate within the trench until backfilling has reached its final level or the approval for the Engineer has been obtained.

Should any subsidence take place either in the filling of the trenches or near about it during

The works the Contractor shall make good the same at his own cost.

Surplus excavated material shall be used to fill in any low spots above the pipeline which are identified on the Drawings or are instructed by the Engineer. Such material shall be evenly placed and compacted in layers not exceeding 200mm thick after compaction. The method of compaction employed shell achieve not less than 90% maximum dry density as determine from IS 2720: Part 7. Unless approved of by the Engineer, the width of areas to be filled shall not exceed 20m.

5.13 Valves

5.13.1 General

Valves shall be as per IS recognized standards. Flanges shall be machined on faces and edges to ISO 7005, IS 6392 or BS 4504.

Valves shall be double-flanged type and the face shall be parallel to each other and flange face should be at right angles to the value centerline. Backside of value flanges shall be machined or spot faced for proper seating of the head and nut.

Valve buried or installed in underground chamber, where access to a hand wheel would be impractical, shall be operated by means of extension spindle and/or keys.

Valves of diameter 450 mm and above shall be provided with lifting eyes and shall have detachable bolted covers for inspection, cleaning and servicing.

Valves shall be suitable for frequent operation as well as operation after long periods of idleness in either open or closed position

The valve stem, thrust washers, screw, nuts and all other components exposed to water shall be of a corrosion resistant grade of stainless steel.

Valves shall be free from sharp projections.

5.13.2 Sluice Valves

Sluice valve shall conform to IS 780 and IS 2906 or relevant internationally recognized standards.

They shall be of non-rising spindle type. The valve shall be furnished with a bushing arrangement for replacement of packing without leakage. They shall also have renewable channel and shoe linings. The gap between the shoe and channel shall be limited to 1.5 mm

The gate face rings shall be screwed into the gate or alternatively securely pegged over the full circumference.

All valves, spindles and hand wheels shall be positioned to give good access for operational personnel.

All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

Materials of Construction:

Body of gate	Cast iron to IS: 210 Gr FG 200
Spindle	Stainless steel BS 970 gr 431 S29
Seat Rings	Stainless steel ASTMA 743 CF8
Back Seat Bush	Bronze; IS 318 Gr LTB2
Shoe & Channel Lining	Bronze; IS 318 Gr LTB2

Size of valves and pressure rating as per Bill of Quantities. Location of valves shall be as per contract drawings. The contractor shall provide test certificates for materials, strength and leakage shall be in accordance with BS 5150/ IS 750.

The design and locations of washouts are shown in drawings. Exact positioning shall be determined by the Engineer with regard to topography. With regard to washouts at least 3 m of the washout pipe work, inclusive of the isolating valve,

measured from the center line of the pipeline shall be laid at the same time as the pipeline and suitably capped to prevent ingress of foreign material. The minimum gradient for the washout pipe work shall be 1 in 100, if not shown in Drawings.

5.13.3 Nuts, Bolts and Washers

Unless otherwise specified, nuts, bolts and washers shall be galavanished and/or zinc electroplated conform to the requirements of IS 1364. Bolts shall be of sufficient length that at least one thread but not more than three threads shall show through the nut when in the fully tightened condition.

5.14 Internal Cleaning of Pipeline

Pipeline shall be cleaned of all dirt, debris, dust or other deposits by repeated hosing of copious quantities of water on the pipe surface and simultaneously rubbing the surface with gunny cloth to the satisfaction of Engineer. Cleaning with metal cleaning solution, acid, wire brushes, scrappers or sand paper shall not be permitted.

The section of the pipeline once cleaned shall not be entered into for any purpose later. Sufficient precaution shall be taken to prevent the ingress of any dirt, debris, or dust inside the section. Failing this the section shall be cleaned again at the discretion of the Engineer.

In the case of above ground pipeline, the length of the section to be taken up for cleaning shall be decided in consultation with the engineer from the point of view of ventilation etc.

In case of buried pipeline a section shall be taken up for cleaning after the work of back filling around and over the pipeline is completed and the spiders have been removed from inside with approval of Engineer.

During the pipeline operation in the adjoining section, the contractor shall take all the precaution to prevent ingress of water, debris, dirt, etc in the cleaned section, failing which the section shall be cleaned again at the discretion of the Engineer. When deemed necessary by the Engineer suitable closures shall be provided at the open end or the ends of the cleaned section.

No separate payment will be made for the work of cleaning and providing closures. The rates coated for the laying of pipes shall include the cost of cleaning also.

5.15 Hydraulic Testing Pipeline

Pipelines and fittings shall be subjected to hydraulic pressure test in the presence of the Engineer which shall comply with IS 5822 unless otherwise specified.

Testing shall be carried out in two stages:

Test of section as construction proceed before internal cement mortar lining

A test of the hole of the pipeline on completion

The contractor shall equip with all plants, equipment, fittings and water necessary for the hydraulic tests. The contractor shall submit to the Engineer, well in advance of the time of test, details of proposals, including the supply of water either by tankers or bore holes. No connections from the existing pipelines will be allowed, nor will any connection to the pipeline and pipe work which would involve cutting, tapping or altering the permanent works be allowed.

Test gauges shall be of approved manufactures having dials at least 200 mm diameter, graduated such that the test pressure is at least 75% of the full-scale reading shall be used. If necessary different gauges shall be supplied for different pipeline section. Two gauges shall be provided for the sole use of the Engineer and shall remain in the engineer possession for the duration of the contract. All gauges shall be dead weight tested and calibrated at the commencement of work and at regular intervals as require by the Engineers.

The contractor's arrangements for testing shall include a suitable means of quick installation and removal of the Engineers gauges during testing.

5.16.1 Testing Procedure

The sectional hydraulic test shall be carried out after the pipeline section to be tested as been laid, jointed and back filled to a depth sufficient to prevent flotation, but leaving the joints exposed which have not been tested. The sections to be tested shall be to the approval to the Engineer and shall be not longer than 2000m or 500 m when either pipeline is laid adjacent to or underneath the carriage way or when section includes an air valve chamber. The joints between each tested section shall be left exposed until the pipeline has passed the test on completion.

This test shall be undertaken within one month of the contractor commencing the laying of the pipes. Should the pipeline fail the test or the contractor fail to undertake the test, all laying and welding work shall come to a halt until that section of pipeline passes a hydraulic test.

Each length of the pipeline to be tested shall be capped or blanked off at each end and securely strutted or restrained to withstand the forces which will be exerted when the test pressure is applied. Testing against closed valves will not be permitted. Washout valves shall be fitted with blank flanges and these together with in-line valves shall be left open. Air valves already fitted shall be permitted to function during the test.

Proposals for testing where thrusts on structures are involved, even where thrust flanges on the piping are installed, shall be submitted, with the calculations of the forces to be carried, to the Engineer for approval.

The method of filling the pipeline with water shall be approved by the Engineer. The length under test shall be filled making certain that all air is displaced through an air valve installed at the top of the blank flange situated at the high end of the line. The length shall then remain under constant moderate pressure, 10 to 20m head of water, for a period of several hours until the pressure can be maintained without additional pumping.

The pressure shall then by slowly increased at a maximum rate of 1 bar per minute to the full test pressure and pumping discontinued for 3 hours or until the pressure has dropped by 10 m, whichever occurs earlier. Thereafter pumping shall be resumed and continued until the test pressure has been restored. The quantity of water pumped to restore the pressure shall be the measure of leakage from discontinuation of pumping until its resumption.

The pipe length shall passes the test if the leakage is not more than 0.33 liters per mm diameter per kilometer per 24 hours for each 100m head of pressure

Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint and repeat the hydraulic test.

No pipeline shall be accepted until the leakage on any length is not more than the rate of leakage specified above and all sources of leakage have been rectified.

The test on completion shall be carried out after all the pipeline sections have been satisfactorily tested and the joints between each section completed to provide a continuous test length between pipelines shall be tested as above except where the Engineer issues such instructions as are necessary for testing parts of the works that have been designed for stresses limited by considerations other than those applying to the pipeline systems.

5.16.2 Test Pressures

Test pressures are to be measured in bars at the center of the blank flange situated at the lowest end of the pipeline under test. Unless otherwise specified or shown on the drawings pipeline test pressure shall be in accordance with the following:

Steel pip and fittings 8, 10 and 11 mm wall thickness 18 bar

Test pressure for sections of pipeline containing air valve chambers shall be such that the pressure at the chamber does not exceed valve design pressure as specified by manufacturer.

When undertaking a Test on completion of the pipeline length may contain pipes of different wall thickness in such cases the lower of the different test pressures shall be used.

5.17 Pipeline Disinfections

Upon completion of a newly laid main, the main shall be cleaned, disinfected and dewatered as directed by the Engineer.

The internal surface of pipelines, specials, appearances shall be disinfected using chlorine solution in accordance with procedure specified in IS 5822. Alternative methods may be adopted with the approval of the Engineer. The chlorinated water shall stand in pipeline for a minimum period of 24 hours and all valves in the system shall be operated twice during this period.

The chlorinated water shall be neutralized and disposed off as directed by the Engineer.

After final flushing and before the pipeline is placed into service, water samples shall be collected and tested for bacteriological quality and shall not indicate the presence of califorms. If the initial disinfections fail to produce satisfactory results, disinfections shall be repeated until satisfactory samples are obtained.

The contractor is expected to carry out the cleaning, disinfecting and dewatering work as a part of laying the pipes and his rates for laying the pipes should include the cost of cleaning and other related works.

5.18 Markings

Details like valves type, size, and cistern number shall be painted on the valve chambers as directed by Engineer.

5.19 Measurement and Payment

The measurement of the pipes for items specified in Bill of Quantities shall be on running meters of net length along the centerline of the pipe excluding the length of specials and appurtenances.

Specials shall be paid separately on the basis of provision made in the Bill of Quantities. For the payment purpose, flanges shall be either included in or excluded as described in the Bill of Quantities. However materials such as nuts, bolts, and washers, etc., shall be included in the respective terms.

Valves shall be paid on number basis as mentioned in the Contract Data.

Payment for fabrication of pipes and specials shall be made after successful testing and delivery to work site. Payment for laying the pipes and specials shall be made as mentioned in the Contract Data.

Lining and coating shall be measured by surface area coated or lined in square meters. For coating the outer diameter (before coating) of pipe barrel shall be considered and for lining internal diameter (before lining) of pipe barrel shall be considered.

VI. ANCILLARY STRUCTURES

6.1 The Contractor shall build Valve Chambers & Thrust Blocks/Anchor blocks and such other miscellaneous structures that may be required at the locations shown by the Engineer and as shown in the drawings or as may be otherwise specified or directed. Unless otherwise specified in this Chapter or advised by the Engineer based on the site conditions.

The various structures shall be built as the pipe laying progresses and the Engineer at his discretion, may stop work entirely on the laying of pipe or construction of other structures, until the construction of the structures already approved by the Engineer are completed by the Contractor.

6.2 Thrust Blocks

Thrust blocks shall be provided for both horizontal and vertical bends as suggested, for effective transfer the hydrostatic thrust developed during the operation of the rising main. They shall be constructed at the locations shown in the alignment drawings, and are of the respective dimensions shown therein. The surrounding virgin land of the thrust blocks shall not be disturbed, to effectively transfer the thrust developed in the main.

6.3 Valve Chambers

RCC valve chambers shall be provided for all valves. These valve chambers are of different sizes suitable for air valves, scour valves & Control valves with RCC pre-cast slabs covering.

6.4 Structures for Crossing Canal/ Nallahs and Other Miscellaneous Structures

Structures for crossing the pipeline over canals/Nallahs and other miscellaneous structures not listed in these specifications but may be required to be built shall be as per construction drawings and as described in Bill of quantities. The materials of construction of workmanship for those structures shall conform to the relevant Standard Specifications. The measurement of quantities involved in these structures for payment shall be done as per dimensions of the respective drawings.

7.0 Service Connections: The House Service Connections shall be made with **CPVC** pipes and specials manufactured as per IS; 15578/2007.

CPVC MATERIALS

The material used in the manufacture of the pipe shall be a rigid chlorinated polyvinyl chloride (CPVC) compound, Type IV Grade 1, with a Cell Classification of 23447 as defined in ASTM D1784. This compound shall be light grey in colour as specified, and shall be approved by NSF use with potable water.

DIMENSIONS

CPVC Schedule 40 & Schedule 80 pipe shall be manufactured in strict accordance to the requirements of ASTM F441 for physical dimensions and tolerances. Each production

run of pipe manufactured in compliance to this standard, shall also meet or exceed the test requirements for materials, workmanship, burst pressure, flattening, and extrusion quality defined in ASTM F441. All belled-end pipe shall have tapered sockets to create an interference type fit, which meet or exceed the dimensional requirements and the minimum socket length for pressure-type sockets as defined in ASTM D2672. This pipe shall have a flame spread rating of < 25 and a Smoke Development rating of < 50 when tested for surface burning characteristics in accordance with CAN/ULC-S102-2-M88 or equivalent.

7.1 Strap/Clamp Saddle

General Specifications:

Strap Saddle for service connection from water distribution mains shall be of wrap around design, wide skirt and wide straps support, which shall reinforce the pipe while providing excellent stability to the saddle.

Saddles for service connections shall be of fastened strap type with threaded outlet for service connection. The service connection threading sizes shall be conforming to IS: 554
Saddles shall be suitable for DI pipes of nominal size 4" (NB 100) to 12" (NB300) with nominal service connection size from ½" (NB 15), ¾" (NB 20), 1" (NB25), 1 ¼" (NB 32) and 1 ½" (NB 40).

The straps shall be elastomer coated (insulated) type for firm grip on pipe as well as to protect the coating on the pipe and to insulate the un-identical metals. The saddles shall be single strap type up to pipe sizes of NB 300 and service outlet of ½", ¾" and 1" and double strap type when the service outlet is 1 ¼", and 1 ½" .

Fasteners shall be of threaded nut-bolt-washer type. Nut-bolts of size ½" (M12) shall be used for saddles of size for 4" (NB 100) and Nut-bolts of size 5/8" (M16) shall be used for saddles of size 6" (NB 150) and above.

The sealing between the saddle and mains shall be obtained by using a profiled elastomer seal matching to the curvature of the pipe. The seal shall be of elastomer type, suitable for all potable water applications.

The Material of construction of the body, straps, fasteners etc. shall be of a non-corrosive material such as engineering plastic (PE/PP) or stainless steel or a combination of both.

The design of the saddle body should be such that, the service connection outlet metal insert shall project out towards pipe side and align with the hole drilled on the pipe to ensure positive locking against rocking or creeping on the pipe, as might be caused by vibration, pressure or excessive external loading.

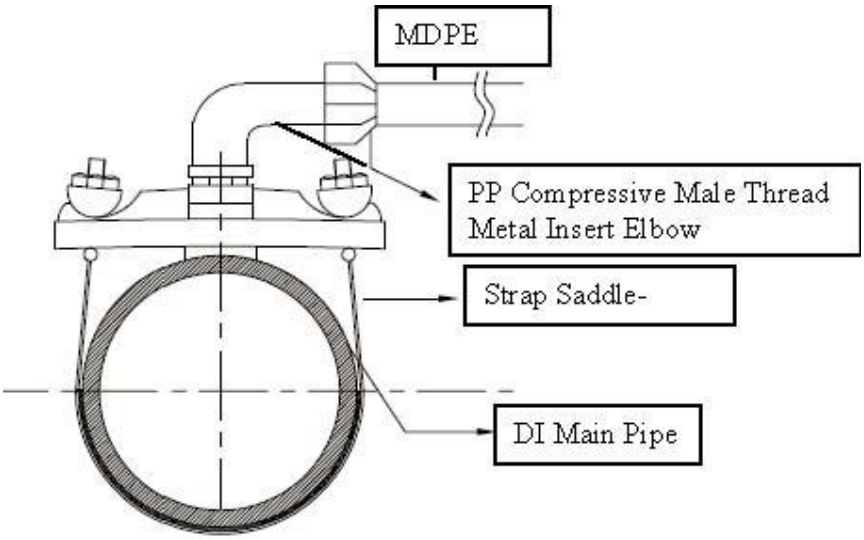
The clamp saddles shall be suitable for maximum working pressures upto 10 bars.

Material and Design Specifications:

Saddle Body: Non-corrosive Engineering Plastic body moulded with Stainless steel threaded metal insert for tapping outlet. Also, the stirrup metal plate shall be duly embedded in the plastic body, except at the place of nut-bolt lugs. Threading size and dimensions shall conform

Note: The 'MDPE' as mentioned in the above drg. shall be read as 'uPVC'.

to IS: 554. The body shall have retaining cavity housing for internal and external retention of the elastomeric seal. Sealing shall be achieved by pressure exerted by the body while fastening the



saddle straps & body on the pipe.

Saddle Strap: Saddle straps shall be made of stainless steel 304 grade to prevent corrosion over the long service life. Strap Insulation: Elastomeric (rubber) insulation / lining shall be such that none of the Stainless-Steel Strap is in direct contact with the pipe. It shall ensure a firm non-slip grip mounting on the pipe to prevent the saddle from rocking or creeping on the pipe, as might be caused by vibration, pressure or excessive external loading.

Saddle Seal: It shall be virgin rubber SBR Grade 30 / NBR (NSF 61 approved). It shall be of type pressure activated hydro-mechanical design. It shall be contoured gasket to provide a positive initial seal which increases with increase in the line pressure. Gasket shall be gridded mat, with tapered ends, with the outlet section having 'o' ring contacting the saddle body multiple o-rings contacting the pipe, preferably with a Stainless-steel reinforcing ring insert moulded to prevent expansion under pressure.

Nuts-Bolts- washer: Stainless Steel Type 304, NC rolled thread, Tightening torque for ½" (M12) nut-bolt: 14-15 kg.m and **for 5/8" (M 16) nut-bolt: 21-23 kg.m**
The general arrangement of Strap Saddle with PP Compressive Male Thread Metal Insert Elbow is shown below;

The joints in service connection between Cpvc pipe and UPVC Ball Valve and the Water Meter shall be tamper proof / not easily dismantled by the Consumers as directed by the Engineer.

7.2 Ferrule Materials

Compression fittings for house service connections shall comply with ISO 14236, with materials of construction as per clause 5 in the Standard as follows: Body – polypropylene Nut/cap - polypropylene Clip ring - POM (acetylic resin) Packing bush - polypropylene "O" ring - NBR Threaded metal inserts - SS304 with BSP threads

For clear identification of water services, fitting nuts shall be coloured blue and the body black. All threads shall be BSP.

The dimensions of compression fittings shall be in accordance with clause 7.1 of ISO 14236. The pressure rating of compression fittings shall be PN16 as per clause 8 of ISO 14236. Performance testing shall be as follows:

Clause 8.2.1 Leak tightness under internal pressure Clause 8.2.2 Resistance to pull-out Clause 8.2.3 Leak tightness under internal vacuum Clause 8.2.4 Long term pressure test for leak tightness for assembled joint Clause 8.3.2.1 MRS value as per ISO 9080 Clause 8.3.3.1 Resistance to internal pressure All materials or components coming into contact with potable water shall comply with the following: Metallic components shall not constitute a toxic hazard, shall not support microbial growth and shall not give rise to unpleasant taste or odours or discoloration.

- Non-metallic components shall be approved as being free from adverse health effects. Compliance with national or international standards shall be demonstrated by production of appropriate third-party certification.

Compression fittings for the conveyance of water for human consumption shall conform to BS 6920 for the effects on water quality, and certificates demonstrating compliance with the following parameters shall be provided: odour and flavour of water, appearance of water, growth of micro-organisms, extraction of substances that may be injurious to public health (cyto toxicity), and extraction of metals.

7.3 Flexible Couplings and Flange Adaptors

Slip-on type couplings shall include the following couplings:

(i) straight flexible couplings;
(ii) stepped flexible couplings;
(iii) flange adaptors.
(iv) dismantling joints

The pressure rating of the couplings shall be suitable for 16 bar working pressure and a test pressure of 24 bar.

The preparation of pipe ends for slip-on type couplings shall be in accordance with the requirements of and the tolerances specified by the joint manufacturer. Couplings shall be installed fully in accordance with the manufacturer's recommendations.

All couplings shall be supplied with transit protection.

7.3.1 Flexible Couplings

Flexible couplings shall be of the steel bolted compression ring type in accordance with AWWA C219.91, capable of allowing flexibility of the joint and removal of the attached pipework. Unless indicated all couplings shall be supplied without the central register.

Protection, both externally and internally, shall be a nylon coating in accordance with UK WIS 4-52-01: Part 1.

7.3.3 Flange Adaptors

Flange adaptors shall be of a bolted compression ring type in accordance with AWWA C219.91, allowing flexibility of the joint and removal of the attached flanged pipework.

They shall be given nylon coating in accordance with UK WIS 4-52-01: Part 1

7.4 Joint repair clamps

Clamps shall be installed fully in accordance with the manufacturer's recommendations.

Joint repair clamps shall be made of cast iron or ductile iron body to BS 2789 Grade 420/12 with Nitrile interlock gasket supplied to fit pipe outside diameter.

The gasket shall be approved for use with potable water and shall be capable of resisting extreme climatic conditions, petrol, oil, gas and water. Clamps shall be supplied complete with brackets and captive bolts with self–stabilising finger brackets to prevent bolt bending.

The pressure rating of the clamps shall be suitable for 10 bar working pressure and a test pressure of 15 bar.

The preparation of the pipe barrel prior to installation of the clamp and its outside diameter shall be in accordance with the requirements of and the tolerances specified by the clamp manufacturer.

7.5: Consumer / Domestic Portable Water Meters.

General
This specification shall be for the supply and installation of 15, 20, 25, 40 and 50mm volumetric cold-water
meters suitable for installation on potable water supplies.
The meters shall conform to the latest version of ISO 4064. The size of meter shall mean the clear internal
diameter of inlet to and outlet from the meter. The overall length of meter between connector faces shall be in
accordance with those lengths as stated in ISO 4064/1 or BS 5738/1, Part 1.
The meter type must have had life cycle testing undertaken as part of the meter pattern approval. Typically,
this would have been achieved by means of an accelerated wear test as described in ISO4064 part3 or EC
Directive 75/33.
Meters shall perform in accordance with ISO 4064 in terms of error and head loss for the stipulated meter
class. Copies of the relevant production test certificates are to be provided by the meter manufacturer.
Meters shall be capable of withstanding a maximum working pressure of 10 kg/cm 2 , a test pressure of 15 kg/cm 2 ,
and a maximum working temperature of 50 o C.

All meters to be offered under this specification shall be multijet dry magnetic type. Meters that have external calibrating devices are not acceptable.
The water meters shall be suitable for installation in horizontal planes without loss of accuracy.
All parts of the meters shall be finished to ensure interchangeability, which is to be guaranteed. The meters
shall be guaranteed against defects in materials and workmanship from the date of installation on the service
connection until completion of the project and defect liability period. Parts to replace those in which a defect
may develop within such period shall be supplied and fitted without charge. Meters shall be designed for easy
installation, removal and re-installation without the use of special tools or equipment and shall be easy to
maintain and repair.
The meter body shall be manufactured from a non-magnetic metal alloy. It shall be constructed in two halves
with threaded joint and watertight seal between the two. Meters are to be robust, resistant to vandalism, and
suitable for permanent submergence in water to IP 68.
The meter shall be supplied complete with a set of nonmagnetic alloy connections containing no less than
comprising cap-nuts, linings and fibre sealing washers.
Meters shall be protected against tampering in reading and shall be sealed with self-lockable seals of approved
type and with unique serial numbers. Seal wires shall be copper wires. The seals and seal wires shall be
supplied by the meter manufacturer. Meters designed to resist vandalism will be preferred.
Each water meter shall be marked on the casing with the following information:
(a) Direction of flow of water on both sides of the meter
(b) Class of meter (or on the counter register)
(c) Maximum flow rate (m 3 /hr)
(d) Serial number
(e) Manufacturer’s name
(f) Country of Origin
(g) Year of manufacture
(h) Name of the Client - BWSSB

The register (counter) shall be direct straight reading in cubic meters with minimum 5digits and fractions of
cubic meters can be in the form of wheels (99999). The number wheels should not be in contact with the water
being measured
The Contractor shall bench test under the supervision of the Engineer 1% of the new meters randomly selected
from delivery batches to confirm satisfactory meter performance in conformity to the metrological class of the
meter.

Consumer meters shall be installed in a low point created in the service pipe to ensure that the meter is always
filled with water in order to lubricate the bearings and moving parts, as well as to prevent hardened
accumulations of debris and the deposition of dissolved salts from the
water due to evaporation.
7.18.1 Technical Particulars
1. Type:
2. Sizes (mm):
3. Applicable standard:
4. Metrological class:
5. Register reading:
6. End connections:
7. Process liquid:
8. Maximum working pressure:
9. Maximum working temperature:
10. Head loss at maximum flow:
11. Internal return flow restrictor:
12. Strainer:
13. Materials of construction:
14. Register dial: inferential multi-jet 15, 20, 25, 40, 50 ISO 4064 Class B minimum Cubic meters
Screwed Cold potable water with suspended particles and chlorine content to local potable water
quality standards 10 kg/cm 2 50 o C <1.0 bar not Required Not required Caps and lids shall be
manufactured from unbreakable and non-corrosive material, corrosion wear resistant and non-toxic
for internals. Dry or dial with magnetic drive coupling.
15. Accessories: Self lockable seals
16. Markings on meter: As above and as per ISO 4064
17. Acceptance and type tests: As per ISO 4064; number of sample meters to be selected for tests
shall be as per ISO 4064
The Contractor shall set up an NABL accredited meter test bench and calibration facility in Bangalore to test
samples of the new meters to be supplied, or utilize external accredited facilities for all new meters testing
requirements. The NABL accreditation test certificate shall be submitted to the Engineer for review andrecord.

7.6: TECHINCAL SPECFICATION OF BULK FLOW METERS

7.6.1 Introduction

The flow measurement system for bulk flow measurement to be used under this contract shall be electromagnetic type meters with GPRS/GSM. Each water meter intended for a potable water supply. It shall comprise two principal components, as follows:

- A flow sensor of the electromagnetic type, which shall be suitable for installation in a buried water main. The sensor shall be connected to the main by means of PN16 flanged connections. The meter shall be suitable for installation in a flooded chamber and for being directly buried.

- An electronic display unit. This shall be installed in an above ground cabinet enclosure in a convenient location, as close as possible to the water meter.

- The meters proposed should have mandatory provision for the external power supply of 12-24 V DC/AC as well as a battery which shall be integral to the Electronic Display Unit/ Transmitter unit. The power backup through the external battery and by any external UPS **shall not beallowed**.

On a minimum, water meter shall be provided with the following facilities at the electronic display unit:

- integral real-time clock for date and time recording of flow data
- integral data logger for storing data for a minimum of 31 days.
- Serial or suitable communication port to enable data to be passed from the display Unitto display flow and pressure details.
- a second serial or suitable communication port for the temporary connection of a laptop /computer
- Input/output block for connecting GPRS transmitter for the transfer of all display /error codes and status functions from the electronic display unit to central SCADA system, through GPRS communication.
- Meters should be commissioned upon installation of each meter so as All data from the meter can be transferred to the central SCADA System as specified by BWSSB.. PSION and Laptop, leads and appropriate software and software licenses shall be provided to facilitate configuration of the water meters and for down-loading the integral data logger for data analysis.

7.6.2 General Specifications for Electro Magnetic Flow Meters

a) Full bore electromagnetic flow meter shall consist of flow sensor (i.e. flow tube), flow transmitter and flow indicator and integrator and any other item required to complete the system. To avoid the effects of disturbances in the velocity profile, a straight and uninterrupted run, upstream as well as downstream from the location of the flow meter shall be provided, as required by the flow meter manufacturer and in line with the applicable standards. Contractor shall finalize the exact location of flow meter in consultation with Engineer.

b) Flow measurement shall not be affected by physical properties of water viz., temperature, pressure etc., within given limits. Contractor shall provide compensating electronic circuits, if required.

c) A lockable enclosure shall be provided for the flow transmitter cum computing unit.

d) Flow meters shall be suitable for the water turbidity at site during various seasons. Flow tube shall be rugged in construction and shall be suitable for continuous operation. Flow tube shall have waterproof construction and shall be suitable for installation on underground /above ground pipe lines.

e). The flow computer and transmitter shall be a single unit suitable for field mounting. It shall accept inputs from flow tube process the signals and shall provide an output proportional to the flow rate. The output shall be 4-20 mA.

a) Particular Specifications:			
1.	Accuracy of flow measurement during FAT	± 0.4% of measured value	
2.	Overall accuracy of flow measurement loop.	± 1.0 % of measured value	
b)	**Flow tube**		
(i)	Application	:	Water applications
(ii)	Type	:	In line, full bore electromagnetic
(iii)	Size of flow tube	:	To suit mains flow parameters, with pipe reducers provided as necessary
(iv)	Process connection	:	Flanged
(v)	Weather Protection Class	:	IP 68 as per IS 13947
(vii)	Material of Construction:		
	Electrodes	:	Hastelloy C276
	Coil Housing	:	non-corrosive
	Flanges	:	Carbon steel
	Grounding ring	:	Hastelloy C276
(viii)	Flow tube Lining	:	*EPDM*
c)	**Flow Transmitter Unit**		
(i)	Type	:	Microprocessor based with facility to configure the ranges.

(ii)	Type of display	:	4 digit backlit LCD / LCD, for flow rate in m3/hr. 8 digit backlit LCD / LCD for totalized flow in ML • Display with 8 digits for main information. Index, menu and status symbols for dedicated information • Key for toggling through the information and reset customer totalizer and call-up function • Selectable default information and accessible menus: - Operator - Meter - Service - Data Logger
(iii)	Units of display	:	• Volume: m3 x 100, l x 100,G x 100, G x 1000, MG,CF x 100, CF x 1000, AF, Al, kl • Flow: m3/min, m3/d, l/s, l/min, GPS, GPH, GPD, MGD, CFS,CFM, CFH
(iv)	Input	:	From flow tube
(v)	Output	:	4-20 mA DC (isolated) proportional to flow rate
(vi)	Power Supply	:	The meters proposed should have mandatory provision for the external power supply of 12-24 V DC/AC as well as a battery which shall be integral to the Electronic Display Unit/ Transmitter unit. The power backup through the external battery and by any external UPS shall not be allowed.
(vii)	Zero and Span Adjustment	:	Factory set Password protection of all parameters and hardware protection of calibration and revenue parameters.
(viii)	Weather Protection Class	:	IP 65 as per IS 13947, IP 67
(ix)	Battery backup for totalized flow	:	Online 2.5 Mva

	Type Capacity Backup Time Data Protection:	Minimum 8 hours considering transfer of real time data to the central server, 2-way communication (minimum 10 polling intervals either way) with the central SCADA server established at BWSSB premises & totalized flow and other related data as required under this contract. • All data stored shall be stored in an EEPROM. Totalizers shall be backed up every 10 min, statistic every hour and power consumption and temperature Measurement every 4 hour. Minimum 31 days of data shall be stored in EEPROM. • Password protection of all parameters and hardware protection of calibration and revenue parameters.
(x)	On line diagnosis & program modification:	Required as following: Diagnostic • Continuous self-test shall include - Coil current to drive the magnetic field - Signal input circuit - Data calculation, handling and storing • Features - Alarm statistics and logging for fault analyzing - Electrode impedance to check actual media contact -Flow simulation to check pulse and communication signal chain for correct scaling - Number of sensor measurements (excitations) - Transmitter temperature (battery capacity calculation) - Low impedance alarm for change in media - Flow alarm when defined high flow exceeds - Verification mode for fast measure performance check - Statistic flow and consumption data - The meter shall be configured to accept the meter program modification from the central SCADA server

		via remote GPRS communication as and when required, transfer error codes to the server for fault analysis
(xi)	Wireless Communication Module	Redundant GPRS modem for Transmission of Process Flow & Totalized Flow data to SCADA system (Make of the Modem shall be of Approved Make List of Flow meters as per Clause No: -6.6)

7.6.2.1 The Flow Sensor

The sensor shall be suitable for being directly buried and shall have a degree of protection to IP 68 (NEMA6). The sensor shall have PN16 flanged end connections.

The sensor shall be suitable for an operating pressure of 16 bar gauge and a system test pressure of 25 bar gauge.

The metering tube shall be suitably lined to withstand abrasion of the fluid. The lining shall be EPDM and shall have been type-tested in an accredited laboratory and have been shown to be suitable for use in contact with potable water (UKWFBS listed).

The electrodes for sensing the voltage induced in the liquid shall be made of type Hastalloy C267.

The coil housing shall be fabricated from corrosion resistant material capable of submerged or buried operation.

The sensor shall be supplied complete with a factory-fitted umbilical cable for communication with the electronic display unit. The cable length shall be determined by the contractor for each meter location, but shall be not less than 20 metres long so that it can be cut on site to suit the selected location for the electronic display unit. The construction of the signal connectors and cable shall protect the water meter from electromagnetic interference and shall be suitable for buried use and outdoor installation. The cable shall be protected by a suitably robust polyethylene sleeve to prevent accidental damage.

The Contractor shall provide all sundry items such as grounding electrodes and/or grounding rings necessary for satisfactory operation of the sensor.

7.6.2.2 The Electronic Display Unit

The enclosure of the electronic display unit shall have a degree of protection to IP 65 or better.

The display unit shall have a configurable password protection for accessing the flow meter menu.

The unit shall have LCD displays to show the following parameters, as selected by the operator:

- Cumulative forward flow
- Cumulative reverse flow
- Cumulative net flow
- Instantaneous flow rate
- Instantaneous velocity
- Minimum night flow
- Peak day flow
- Pressure
- Date and time

The user shall be able to configure the electronic display unit to display:

- Cumulative flow in m^3
- Flow rate in m^3/h or l/s
- Velocity in m/s
- Pressure in m or kg/cm2

There shall also be status indicators for each of the following conditions:

- Battery low
- Fault
- Empty pipe

7.6.2.3 Calibration:

The Electromagnetic flow meter shall be calibrated for the full flow range specified as per BS EN 29104 (Methods of evaluation of electromagnetic flow meters). The calibration method shall be either gravimetric method as per ISO 4185 (Measurement of fluid flow in closed conduits – weighing method).

The 'test bed' shall be accredited by national /international certifying authority. The Contractor shall produce accreditation certificates for the test facility and manufacturer calibration certificate for each flow meter, for the review by Engineer. The Contractor shall also demonstrate complete calibration on the test bed in the flow meter laboratory during witnessing of meters as per Clause 6.9. The flow meter shall be acceptable if the

accuracy and repeatability is equal to or better than those specified.

7.6.3 Submissions by the contractor:

Functional Design Specifications: **-UFW Instrumentation**

The Contractor shall submit a complete functional design specification (FDS) for approval by the Engineer within 1 months of the award of the contract. This document shall serve as the primary mechanism by which the Engineer may confirm that the Contractor possesses an accurate understanding of the system and its control requirements. The Contractor is encouraged to obtain clarifications and to suggest refinements to the control descriptions contained in this Specification.

The FDS shall comprise an overall description of the process, its functioning and control, and a detailed description of each section of the control system. The detailed description shall include a step-by-step control description which defines the function of each piece of equipment and each control action and interlock.

The FDS shall describe the 'fail-safe' features incorporated into the design for the event of failure or loss of an input signal affecting a control loop or process sequence.

The FDS shall describe control actions taken and monitoring functions which remain available during a power failure/battery failure, and any automatic controls or sequencing which take place during system start-up and shut-down.

The FDS shall be presented in a clear and precise manner and shall include figures or drawings where appropriate.

The Contractor shall submit and obtain approval of the FDS from the Engineer before beginning the detailed control system design. The contractor should take note of the importance of this obligation.

In general, the submissions of the instrumentation system shall comprise the following as a minimum:

(a) The detailed technical data sheets shall be submitted for all online filed instruments to the Engineer for approval prior to the procurement.

A functional design specification (FDS) for system. This document shall serve as the primary mechanism by which the Engineer may confirm that the Contractor possesses an accurate understanding of the system and its requirements.

The FDS shall include a detailed block diagram of the system with description of the scheme to be provided.

The FDS shall include a description of the interface of Instrumentation system (Online Flow & Pressure) withcentral SCADA system of BWSSB.

The Contractor shall submit a preliminary FDS and obtain approval before the system architecture design is finalized or detailed design takes place. The Contractor shall formally notify the Engineer for approval of any amendments or additions to the approved FDS. The final FDS shall be submitted for approval before submission of the factory acceptance test definition documents. The Contractor should take note of the importance of this obligation.

(b) Layout drawings for each piece of equipment fabricated or assembled by the Contractor, showing the position of each component with required clearances where applicable, and with overall dimensions.

(c) Wiring diagrams indicating each component of the system and all wiring and cabling thereto, showing manufacturers, types, duties, ranges and nomenclature, with inputs, outputs, cable wiring and terminal identifications clearly marked.

(d) Complete input and output list giving type, circuit number, tag name, short description, outstation, database reference, associated field device, range (if applicable), critical/non-critical alarm status and the like.

(e) Description of quality control methods and approvals.

(f) Detailed works and factory acceptance test procedures.

(g) Program for manufacture, delivery, installation and commissioning.

(h) Appendices, as necessary, to include manufacturer's literature for each item of equipment supplied.

(i) Operation and maintenance manuals detailing the following:

a. General description and operating principles;

b. Technical description of the equipment (manufacturer's standard brochures only being acceptable if the particular item of equipment described is clearly designated, adequate information is supplied, and irrelevant information is deleted or otherwise delineated)

c. Complete operating instructions defining the sequence of operations, including flow charts;

d. Procedures for dismantling, cleaning, servicing, replacing parts and reassembling, including recommended clearances and tolerances;

e. Details of all instrument and equipment settings as applicable to this contract;

f. Maintenance and lubrication schedules;

g. Fault diagnosis procedures;

h. Dated and priced list of significant spare parts and special tools, including identification numbers and sources of supply;

i. Simplified arrangement drawings showing all components of the equipment.

(j) General operating manual comprising the following:

a. General description and operating principles;

b. Operating instructions for normal procedures in a step-by-step format including control operations, requirements for display or printing of data, performance

monitoring, response to alarms or failures, changing of operational parameters, and manual data entry.

7.6.4. Factory Tests & Inspection

Each water meter shall be subjected to a hydrostatic test and shall be calibrated in the manufacturer's works prior to dispatch. Calibration and hydrostatic test certificates and QAP shall be provided before disptach.

7.6.5 Installation

(a) Flow Sensor and Electronic Display Unit

Every electromagnetic water meter shall be installed in accordance with the manufacturer's instructions and recommendations. In particular, the sensor body shall be installed such that it is always full of water to ensure full bore meter operation at all times, even during periods of intermittent supply, and with the electrodes always submerged. This may be achieved by utilizing natural dips in the pipeline, re-laying existing pipes with deflections at joints to create the necessary installation conditions, or creating a low point for the sensor body. Pipe transition slopes shall be such as to ensure any debris suspended in the flow of water is carried through the meter without any deposition. Pipe reducers shall be used to minimize excavation depths and pipework modifications. A slab or plate shall be buried above the sensor to warn other contractors of its location beneath and to provide appropriate protection.

Wherever a water meter is to be installed in a water main with cathodic protection, insulating flanges shall be provided on both sides of the sensor and insulated copper straps shall be installed to provide electrical continuity between the pipes on each side of the sensor.

The electronic display unit shall be installed on a removable backboard in a vandal-resistant weatherproof IP65 floor, wall or post mounting cabinet enclosure. The enclosure shall be constructed from galvanised steel which is at least 3 mm thick. The enclosure shall have a hinged access door, which shall have a facility for padlocking in the closed position. Batteries shall be easily accessible for periodic changing. For floor mounting enclosures, the enclosure shall be mounted on a concrete plinth, the surface of which shall be at least 150 mm above the surrounding finished ground level. A cable duct shall pass through the plinth to enable the cable from the flow sensor to enter the enclosure. A label showing details of the Employer's name and the water meter's unique reference number shall be fixed to the external face of the access door. Contractors or equipment manufacturers details shall not be fixed to the external face of the access door.

The enclosure shall be well-ventilated, dust-proof and vermin-proof, and be suitable for

robust use in a tropical climate. It shall also be suitable for:

- The housing of the integral data logger and the temporary housing of a battery powered data logger which could periodically be used in conjunction with the water meter
- the permanent housing of any lightning protection system
- the permanent housing of GPRS transmitter and battery pack, and any other items necessary to facilitate communication with the SCADA system.
- mains pressure recording - see (b) below

Except where the cable is underneath the concrete plinth, there shall be a minimum of 500 mm cover for the cable. The cable shall be surrounded by a sand bedding at least 75 mm thick and interlocking cable protection tiles shall be installed above the cable. An 'electric cable' warning tape shall be installed above the tiles. Wherever practicable, the cable shall be installed at least 600 mm away from any other cables.

Details of the sensor, including its diameter and the size of main together with a unique reference number, shall be permanently indicated on the outside of the cabinet enclosure housing the electronic display unit. A laminated copy of the record plan shall be installed in each meter cabinet.

7.6.6 Particular Requirements for Field Instruments and Communication Equipment

The Contractor shall commission and make operational the field instruments and communication equipment's upon installation. Please note that the Contractor has to bear all communication costs including SIM charges &internet and any other cost during the construction period ,defect liability period.

7.6.7 Transferring Field Data to SCADA System:

The data from Bulk Flow meters should be transferred to BWSSB Server(The Server shall be provided by BWSSB)

B- Scope of Work for Integration:

As part of this current contract, the contractor's scope of work on a minimum shall include to transmit the data from each bulk meter to the central server via wireless redundant communication link (GPRS). During detailed engineering (DDE), the final integration server (central SCADA server) tie in point shall be finalized between BWSSB and the contractor for the data to be transmitted to the central server.

As part of scope of work in this contract, the contractor shall conduct a interoperability test to confirm & demonstrate that the data from the bulk flow meters can be received & transmitted by the central SCADA server using appropriate OPC server & client software. The test shall be carried out in presence & co-ordination with the central SCADA server.

The contractor shall note that the bulk flow meter data which is to be transmitted to the central SCADA server server is to be mapped / programmed in the same format as required at central SCADA server for integration. Ensuring that the data is as per the format required by the central SCADA server shall be part of integral park of the contract. The contractor shall be responsible for the availability of bulk flow meter data at the integration Front end processor servers (FEP) end at all times. Contractor shall note the importance of this clause.

The contractor shall be responsible for the instrumentation system in transferring their data from various online field instruments to Central SCADA system.

Road Restoration

The road surface has to be restored to its original state as per MORTH and technical specification and as per the construction drawing.

SECTION 8:

DRAWINGS

SECTION 9:

BILL OF QUANTITIES

Note:

(1) Item for which no rate or price has been entered in will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities (refer: ITB Clause 11.2 and CC Clause 37.2).

(2) Unit rates and prices shall be quoted by the Tenderer in Indian Rupees.

(3) Where there is a discrepancy between the rate in figures and words, the lower of the two will govern. [ITT Clause 24.1(a)]

(4) Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by quantity, the unit rate quoted shall govern [ITT Clause 24.1 (b)]

Part A - Design and Management			
Item No.	**Description**	**Unit**	**Quantity**
1.1	Topographical map by Undertaking topographical survey, Strip survey wherever required, distribution network surveys to confirm pipe routes, material and size, location of valves, pipe inter-connectivity, etc. and marking the information GIS and undertake house to house surveys to confirm meter details and functionality, illegal connections and consumption, etc. Conducting stip survey of the road, by carrying the nearest GTS benchmark @every 30m interval and junction points, marking the levels in the construction drawing to be submitted for approval.	Sq Km	0.45
1.2	Develop, up-date and maintain calibrated strategic and DMA network models using compatible software (EPAnet, WaterCAD, etc.) and, in accordance with the Specifications, design / establish district meter areas (DMAs) using the models, site survey data and any necessary additional site investigations to confirm District Meter, valve and pipe sizes and locations; identify (under-sized) pipe replacement requirements; prepare and submit DMA Design Reports; hand over the updated network models to Employer at end of contract.. Prepare and submit Final Report incorporating the Post Assessment on each DMA and as well as Contract area as specified in the document. (six hard copies and one soft copy).	Sq Km	0.45

1.3	Establish pressure/flow monitoring points and undertake Pressure Zero Tests (PZTs), make temporary flow measurements, and undertake regular pressure and flow monitoring for all DMAs in accordance with the Specification; prepare and submit PZT Completion Reports.	No	0.45

Part B: Civil Works, Installation and Other Services.			
Sl No.	**Description**	**Unit**	**Qty**
1	Earth work excavation for pipeline trenches in all kinds of soils by mechanicalmeans as per drawing and technical specifications, including setting out,construction of shoring, strutting, barricading, caution lights, bracing, usingsight rails & bonding rods at every 100 mm wherever necessary as directed,removal of stumps and other deleterious matter, dressing of sides and levellingthe bottom of trench to the extent required , utilising the available excavatedearth locally for the work etc., and all other appurtenances complete in thefollowingstrata.All kinds of soils. Depth upto 1.50 m	Cum	3124.88
2	**Earth work** Depth exceeding 1.5 m, but not exceeding 3 m	Cum	156.00
3	Earth work excavation for pipeline trenches by mechanical means as per drawing and technical specifications, including setting out, construction of shoring, strutting, barricading, caution lights, bracing, using sight rails & bonding rods at every 100 mm wherever necessary as directed, removal of stumps and other deleterious matter, dressing of sides and levelling the bottom of trench to the extent required , utilising the available excavated earthlocally for the work and all other appurtenances to complete in the followingstrata.Ordinary/soft rock (without requiring blasting) Depth upto 1.50 m	Cum	469.00
4	Earthwork excavation **Depth exceeding 1.5 m, but not exceeding 3 m**	Cum	23.00

5	Earth work excavation for pipeline trenches by mechanical means as per drawing and technical specification, including setting out, construction of shoring, strutting, cost of blasting materials, barricading, caution lights, bracing, using sight rails & bonding rods at every 100 mm wherever necessaryas directed, removal of stumps and other deleterious matter, dressing of sides and levelling the bottom of trench to the extent required , utilising the availableexcavated earth locally for the work and all other appurtenances to complete inthe following strata.Hard rock blasting prohibited) Depth upto 1.50 m	Cum	62.00
6	Depth exceeding 1.5 m, but not exceeding 3 m	Cum	3.00
7	Refilling available earth around trenches/pipelines, cables in layers notexceeding 20 cms in depth, compacting each deposited layer by ramming after watering with a lead upto 50 m, and lift upto 1.5 m. Including cost of all labour complete as per specifications	Cum	2725.113
8	Spreading of stone dust: Supplying and providing stone dust in the station yard or whereever required including watering, ramming, conslidiating and dressing. the rates includes the cost of the material, labour charges, required tools and plants etc, complete. work shall be carried as per instruction of engineering in charge of works as per standard proceudre	Cum	277.00
9	Dismantling of Flexible pavements and disposal of dismantled materials and stacking serviceable and unserviceable materials separately By Mechanical Means Bituminous course**For Asphalt surface/ pavements**	Cum	625.10
10	Dismantling of cement concrete pavement by mechanical means using pneumatic tools, breaking to pieces not exceeding 0.02 m3 in volume and stock piling at designated locations and disposal of dismantled materials and stacking serviceable and unserviceablematerials separately	Cum	267.90
11	Providing and laying in position Ready Mixed or Batch Mixed concrete as perIS 10262 mix design procedure for Cement Concrete works in all types ofStructures other than Road works, using coarse aggregate and fine aggregatederived from natural sources, Ordinary Portland Cement (OPC) @ 75% & GGBS@ 25% proportion, admixtures to accelerate / retard setting of concrete, toimprove durability and workability without impairing strength; includingpumping of concrete to site of laying, curing, carriage for all leads; but excludingthe cost of centering, shuttering, finishing and reinforcement as per direction ofthe Engineer-in-charge.**RMC M10 Grade**	Cum	122.45

12	Providing and laying in position Ready Mixed or Batch Mixed concrete as per IS 10262 mix design procedure for Cement Concrete works in all types of Structures other than Road works, using coarse aggregate and fine aggregate derived from natural sources, Ordinary Portland Cement (OPC) @ 75% & GGBS @ 25% proportion, admixtures to accelerate / retard setting of concrete, to improve durability and workability without impairing strength; including pumping of concrete to site of laying, curing, carriage for all leads; but excluding the cost of centering, shuttering, finishing and reinforcement as per direction ofthe Engineer-in-charge.**RMC M20 Grade**	Cum	185.018
13	**CONCRETE AND ALLIED WORKS:** Providing and fixing of formwork including centering, shuttering, strutting, staging, propping, bracings etc. Complete and its removal for anchor and thurstblocks.(For foundation sub structure of cross drinages @ 5% on finished rate of concrete/cum)	Smt	130.00
14	KSRB 4.9.2 : Providing T.M.T steel reinforcement for R.C.C work including straightening, cutting, bending, hooking, placing in position, lapping and / or welding wherever required, tying with binding wire and anchoring to the adjoining members wherever necessary complete as per design (laps and wastage shall not be measured and paid) cost of materials, labour, HOM of machinery complete as per specifications. Specification No. KBS 4.6.3 with all lead and lift complete for road restoration, anchor blocks, thrust blocks, saddle supports and any other concrete works.TMT Fe 550 / 550 D	T	0.25
15	**D.I.Pipe :** Providing and laying Ductile Iron pipes of class conforming to IS8329:2000 with latest amendments, conveying to work site, rolling and lowering into trenches, laying true to line, level and perfect linking at joints, testing and commissioning, including loading and unloading at both destinations, cutting of pipes wherever necessary, jointing with DI specials (excluding cost of specials) and rubber gaskets, cleaning the socket and spigot end with soap solution, applying soft soap to the socket and spigot ends before insertion of rubber gaskets, jacking and fixing in perfect conditions etc. The cost to include soap solution, soft soap,waste etc. and giving necessary hydraulic test to the required pressure as per ISS with all lead and lifts and cost of all jointing materials. (The contractor will make his own arrangements for water for testing. Earth work excavation in trenches to be measured and paid for seperately) Note: In sewerage projects for internal cement mortal lining (CML) of DI pipes, if High Alumina Cement (HAC) as recommended in Annexure B clause 16.3 of IS8329:2000 is considered in place of Slag or Sulphate Resistance Cement (SRC), the cost of pipes may be increased by 5-6% rom the prices listed. For DI K9 pipes:		

	For - 100 mm diameter	RM	4790.00
16	**Do for - 150 mm diameter**	RM	250.00
17	Do for - **200 mm diameter**	RM	500.00
18	Do for - **250 mm diameter**	RM	100.00
19	Do for - 3**00 mm diameter**	RM	400.00
20	Providing and fixing of DI specials with ISI mark confoming to IS 9523 / 2000 suitable for jointing 100 mm to 600 mm dia DI pipes coated with rust prevention coatings as below: NOTE: A) External coating: a) Metalic zinc with finishing layer of bituminous as per Annexure "A" of IS:9523/2000 b) Zinc rich paint with finishing layer of bituminous as per Annexure "A" of IS:9523 / 2000 c) Bituminous paint as per Annexure "C" of IS:9523 / 2000 B) Internal Lining: a) Portaland Cement (with or without additives) mortar as per Annexure - "B" of IS:9523/2000 b)Cement Mortar with coat coat as per Annexure "B" of IS:9523 / 2000 c) Bituminous paint as per Annexure "C" of IS:9523 / 2000 etc. complete in road / footpath / verge	Kg	4530.00
21	Providing and fixing DI Resilient seated soft sealing SLUICE VALVE of variouis dia. with body bonnet of Ductile Iron (DI) conforming ti IS-1865 with the latest amendments and of grade GGG 40/50, shaft of stainless steel, wedge fully rubber lined with EDPM seals of NBR and the valves hould be vacum tight and 100% leak proof with face to face dimensions as per IS 14846-2000 with the latest amendments only. The stem sealing should be with toroidal sealing rings (minimum 2 " O " rings). Body and bonnet should be coated with Electrostatically applied Epoxy Powder Coating with minimum coating thickness of 250 micron both inside and outside. The rate is inclusive of cost of valves, T.P set, galvanized bolts & nuts and rubber insertions etc. but excluding earth work. For PN-10: (Note: TP set should be considered only for DI pipes estimate. For MS pipes estimates, TP sets cost of corresponding dia shall be deducted from the SR rates of valves and provision for corresponding dia MS flanges should be made in the estimate.) etc. complete		
	For 100mm dia.	no	48.00
22	for 150mm dia	no	1.00
23	for 200mm dia	no	2.00
24	for 250mm dia	no	1.00
25	for 300mm dia	no	1.00

26	Providing and laying at site CI/DI Valve box for sluice valves, manufactured as per IS 3950 /1976. the cost includes transportation taxes and duties, labour charges for fixing at site including all tools and tackles etc. and fixing on CC bed of 1:3:6 etc., Complete. **@ 35 Kg /No.**		
	100 to 600 mm diameter in road / footpath	Kg	1696.00
27	Construction of RCC valve chambers, with precast RCC slabs including additional excavation, backfill and reinstatement, all in accordance with the Specification, and as directed by Engineer		
28	150mm diameter in road / footpath	no.	1.00
29	200mm diameter in road / footpath	no.	1.00
30	250mm diameter in road / footpath	no.	1.00
31	Manufacturing, providing, transporting, rolling, lowering, laying & jointing, testing, commissioning of ERW (Electric Resistance Welded) SAW (Submerged Arc Welded) MS pipe (Fe-410 grade) conforming to IS 3589-2001 with latest amendments including perfect linking and welding of joints to correct position including cost and conveyance of pipes and materials with all lead and lift, cost of all labour and giving satisfactory hydraulic test as per IS 3589-2001 with latest amendments for test pressure and working pressure both at factory and site etc., complete as per detailed specifications with inside C.M. 1:1.5 lining of minimum 10mm thick upto 610 mm OD & minimum 12mm thick beyond 610 mm OD and out side minimum 25 mm thick coating in CM 1:3 over 50 x 50 mm weld mesh of 13 gauge, including loading and unloading of pipes for the following diameters and specified thickness of plate as noted below, including bailing out of water wherever necessary. The rates are inclusive of all taxes and duties. (Contractor will make his own arrangement for procuring water for testing).Manufacturing, providing, transporting, rolling, lowering, laying & jointing, testing, commissioning of ERW (Electric Resistance Welded) SAW (Submerged Arc Welded) MS pipe (Fe-410 grade) conforming to IS 3589-2001 with latest amendments including perfect linking and welding of joints to correct position including cost and conveyance of pipes and materials with all lead and lift, cost of all labour and giving satisfactory hydraulic test as per IS 3589-2001 with latest amendments for test pressure and working pressure both at factory and site etc., complete as per detailed specifications with inside C.M. 1:1.5 lining of minimum 10mm thick upto 610 mm OD & minimum 12mm thick beyond 610 mm OD and out side minimum 25 mm thick coating in CM 1:3 over 50 x 50 mm weld mesh of 13 gauge, including loading and unloading of pipes for the following diameters and specified thickness of plate as noted below, including bailing out of water wherever necessary. The rates are		

	inclusive of all taxes and duties. (Contractor will make his own arrangement for procuring water for testing).		
	OUTER DIA 406mm dia, 6mm thick	rmt	300.00
32	Manufacturing, providing, transporting, rolling, lowering. Laying and jointing, testing and commissioning of MS specials of min 6mm and 8 mm thick conforming to IS 7322.1985 with latest ammendments, perfect linking and welding of joints to correct position including cost and conveyance of materials with all lead and lift, cost of labour and giving satisfactory hydraullic teas as per IS 3589 ,2001 with latest ammendments for test pressure and working pressure both at factory and at site etc., complete as per detailed specifications with inside lining two coats of food grade apoxy painting of approved make with each coat of 250 micron, thick (after dry) over one coat of food grade apoxy primer of approved make with minimum of 50 micronthick (after dry) and outside 25mm thick coating in CM 1:3 by providing 50 x 50mm weld mesh including loading and unloading of pipes for the following catagory to suit PSC/MS/CI/AC/DI/PVC Pipes. The rates are inclussive of all taxes and duties. (The weight of the M.S. Shall only be considered before lining and coating for arriving the rate). The thickness of the plate will be specified by the Engineer (Contractor will make his own arrangements for procuring water for testing). Note: No negetivetollarance in respect of tickness is permissible. (The work includes tightening the joints with bolts and nuts to the flanges, the cost inclusive of flanges bolts, nuts "o" ring to correct position including cost and conveyance of materials with all lead and lift, cost of labour		
	Up to and inclusive of 500 mm dia of pipe of 6mm thick, (with inside and out side lining two coats of food grade apoxy painting of approved make 250 micron thick (after dry) for bends, branches, MSMJ Joitnts, tapers and all other type of specials as required at site prepared to suit the site condition.	Kg	2000.00
33	Above 500 mm dia of pipe with 8mm thick inside lining two coats of food grade apoxy painting of approved make with each coat of 250 micron, thick (after dry) over one coat of food grade apoxy primer of approved make with minimum of 50 micronthick (after dry) and outside 25mm thick coating in CM 1:3 by providing 50 x 50mm weld mesh) for bends, branches, MSMJ Joitnts, tapers and all other type of specials as required at site prepared to suit the site condition.	Kg	700.00
34	Disposing off the surplus earth of all types up to all distance by vehicle including loading and unloading with all lifts, labour, HOM of machinary etc., complete. (UPTO 40 KMS) for pipe volume, concrete road, asphat surface cutting.	Cmt	1018.333

	Service Connections - New Ductile Iron and Existing Cast Iron Mains (in good condition)		
35	Supply, laying, jointing, Testing and commissioning of service connections making bore holes for fix house service connections including road cutting, excavation, backfilling, disposal and road restoration with Male thread Metal Insert Elbow as per ISO 14236 with one end Compression joint and other end Male thread and Tested as per BS 6920 for Drinking water in any designated Laboratory, on mains not exceeding 200mm nominal diameter CPVC B68 service pipe of minimum 20 mm diameter, length not exceeding 3.0m, including strap Saddle and UPVC Ball Valve with one end Compression joint and other end Female joint as per ISO 4422-4 as per specification and as directed by Engineer.		
	15 mm / 20mm connection in road / footpath / verge	no.	980.00
36	25 mm connection in road / footpath / verge	no.	3.00
37	Supply, laying, jointing, of additional length (exceeding 3.0m) of CPVC service pipe (As per IS 4985:2000) including road cutting, excavation, backfilling, disposal and road restoration as per specification and as directed by Engineer maximum length for a house connection should not exceed 3 mts.		
	20mm connection in road / footpath / verge	m	1960.00
38	25mm connection in road / footpath / verge	m	9.00
39	Supply, laying and jointing of GI pipe of class B for encasement of CPVC service pipe as per specification and as directed by engineer.		
	20mm connection with 40mm GI pipe	m	980.00
40	25mm connection with 40mm GI pipe	m	3.00
	Trial Holes - Excavate and Backfill		
41	Trial holes are excavations carried out with the approval of the Engineer to investigate pipe network details, connectivity, etc. Rate to include road cutting, excavation, backfilling, disposal and road reinstatement of original surface for the following diameters upto 2.5m depth to invert of pipe as per specification and as directed by Engineer.		
	Depth not exceeding 1.5m in road/footpath/verge	no.	30.00
42	Depth greater than 1.5m and not exceeding 3.0m in road/footpath/verge	no.	6.00

43	**Fixing New Air valve on pipeline:** Providing and fixing kinetic AIR VALVE of PN 16.0 for automatic discharge of accumulate air during working condition, conforming to IS 14845/ EN 1074-4. Body and bonnet of DI conforming to IS-1865 of grade GGG-40/50, seals are made of approved EPDM, SS 304 float, guide and internals. Flange drilling according to IS-1538 with appurtenances.complete. Body and bonnet shall be coated with electrostatically applied epoxy powder coating with a coating thickness of 250 micron both inside and outside etc. complete		
	100 mm dia	Each	1.00
44	Dismantling size stone masonry in clay mortar and stacking the size stone with in a radius of 50 m and removing the debries to a distance upto 200 m cost of labour charges complete and as directed by the Engineer	Cmt	138.00
45	Reconstruction of stone masonry with cement mortar 1:6 with the available stones including cost of labour, curing etc., complete	Cmt	138.00
46	Removing and refixing of B.S. Slabs/RCC Slabs of drain and refixing after completion of the work with all tools and tackles	Smt	300.00
47	KSRRB M400-Providing, laying, spreading and compacting graded stone aggregate to **wet mix macadam** specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver/grader in sub-base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density. MORTH Specification No.406.	CUM	552.00
48	KSRRB M400-6.1:Construction of granular sub-base by providing close graded cushed stone aggregates of granite/ trap /basalt material,mixing in a mechnical mix plant at OMC ,carriage of mixed material to work site,spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density ,complete as per specifications A.Plant Mix Method For Grading-III Material	Cmt	31.00
49	KSRRB M500-6: Prime Coat over WMM/WBM Providing and applying primer coat with SS1 grade Bitumen Emulsion on prepared surface of granular base including cleaning of road surface and spraying primer at the rate of 0.70 kg/m2 using mechanical means.. MORTH specification No.502.	Sq.m	2455.00

50	KSRRB M500-13:Providing and laying Bituminous Macadam with 120 tph capacity hot mix plant batch type using crushed aggregates of specified grading premixed with bituminous binder VG-40 @ 3.3% by weight of mix, transported to site, laid over a previously prepared surface with mechanical paver finisher to the required grade, level and alignment and rolled as per clauses501.6 and 501.7 to achieve the desired compaction	CUM	240.00
51	Providing and applying tack coat with RS1 Bituminous Emulsionusing emulsion pressure distributor at the rate of 0.25 kg/m2 on Granular Surface.	Sq.m	2455.00
52	Providing and laying Bituminous Concrete with 120 TPH capacity hot mix plant batch type using crushed aggregates of specified grading, premixed with bituminous binder VG-30 @ 5.2 per cent of mix and filler, transporting the hot mix to work site, laying with mechanical paver finisher to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 507 complete in all respects	CUM	240.00
	DMA EMF Meters		
53	Supply, Installation and commissioing of EMF District Meters, Pressure transmitters, Air valve, tappings and all necessary fittings /reducers/ couplings/pipe specials and any pipeline modifications, above ground enclosures, transferring data from DMA meters to exisiting BWSSB SCADA server via GPRS for the following diameters upto 3m depth to invert of pipe as per specification and as directed by Engineer. (inclusive of cost of GPRS/GSM/latest transmitters, specials, air valves etc., other than meters as per drawing).(The meters proposed should be Battery operated with GPRS transmitter). The rate shall be inclusive of cost of stationaries, consumables, for all moniteringequipments, communication systems and all accessories.		
	150mm diameter in road / footpath / verge	no.	1.00
54	200mm diameter in road / footpath / verge	no.	1.00
55	300mm diameter in road / footpath / verge	no.	1.00
	Construct and Install CPP and AZP Monitoring Points and Temporary Flow/Pressure Measurement Points in DMAs		

56.0	Excavate, procure and install fittings (tapping bands, ferrules, minor pipework, plugs, etc.), construct small chambers where necessary, backfill and reinstate monitoring and temporary flow measurement points. Fix and remove pressure gauges, pressure transducers, insertion flow meters and data loggers, etc., as necessary. Rate to include for removal, backfilling and reinstatement of temporary installations.	no.	3.00
57.0	Supply andinsallation and commissioning of pressure data loggers with inbuilt pressure sensors and GPRS transmitters. The rate shall be inclussive of warrantee for construction period and operation and maintenance period. The rate shall be inclusive of cost of stationaries, consumables, for all moniteringequipments, communication systems and all accessories.	no.	3.00
	Installation, Testing& Commissioning		
58.0	Interoperability testing shall include testing with Existing BWSSB SCADA or Any system with external OPC server and client software to ensure data portability and the system to be commisioned and ready for use in the monitoring of the mandatory works by the end of the 7th month from the date of commencement.	Lot	1.00
	TOTAL		

SECTION 10:
FORMAT OF BANK GUARANTEE FOR SECURITY DEPOSIT

To: _____ [name of Employer]
_____ [address of Employer]
WHEREAS _____ [name and address of Contractor] (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ [name of Contract and brief description of Works] (hereinafter called "the Contract");
AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;
AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;
NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Rs._____ [amount of guarantee] [63]_Rupees_____ _____[in words], and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ [amount of guarantee][64] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.
We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.
We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.
This guarantee shall be valid until 30 days from the date of expiry of the Defects Liability Period.
Signature and seal of the guarantor _____
Name of Bank _____
Address _____
Date _____

[63] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract

[64] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract